

Woods Hole Oceanographic Institution



Gulf of Maine Seals - populations, problems and priorities



by

A. Bogomolni, G. Early, K. Matassa, O. Nichols and L. Sette

Woods Hole Oceanographic Institution
Woods Hole, MA 02543

June 2010

Technical Report

Funding was provided by the Woods Hole Oceanographic Institution Marine Mammal Center

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Gulf of Maine Seals - populations, problems and priorities

Final Report



May 28th – 29th 2009

WHOI, Quissett Campus, Clark Bldg. 507

Sponsored by the Marine Mammal Center at WHOI

Report written by A. Bogomolni, G. Early, K. Matassa, O. Nichols and L. Sette

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Abstract

As pinniped populations shift and change along the northeast U.S. and Canadian coastline, so too do the interests and issues of regional residents, scientists and stakeholders. In May 2009 the Woods Hole Oceanographic Institution (WHOI) sponsored a meeting resulting in recommendations in three key areas regarding pinnipeds: population dynamics, human interaction and disease/health. The population group recommended: developing long-term surveys over all seasons and geographic ranges, coordinating sampling efforts for dietary research, refining correction factors for survey results, increasing documentation of fishery interactions and developing means of funding. The human interactions group recommended: addressing marine debris, developing survey, reporting and retrieval protocols for discarded fishing gear, studying impact of and expanding education and outreach for commercial seal watching, researching methods to deter depredation from fishing gear, streamlining the permitting processes for acoustic deterrent and gear modification research, and increasing cooperative research and outreach to the fishing community. The health and disease working group recommended: establishing baseline health indicators, addressing priority disease concerns, creating a pool of resources for standardized analysis of normal and unusual health event monitoring, determining standard health baselines for release, establishing a health consortium, improving communication along the coastline and establishing long term funding and ongoing collaboration.

KEYWORDS: populations, pinnipeds, northeast United States

Gulf of Maine Seals - populations, problems and priorities

The purpose of this meeting was to bring together representatives from key interest groups to identify and discuss issues concerning pinnipeds in the Gulf of Maine.

- Goals:**
1. To build community among stakeholders with an interest in pinnipeds in the region.
 2. To identify issues surrounding pinnipeds living in the Gulf of Maine.
 3. To formulate strategies and suggest tools for addressing important issues.

Format:

A two-day meeting with invited lectures, workshops, formal and informal discussion.

Rationale and Background

“I feel that the [seal] bounty system is extremely and unnecessarily cruel.”

Anita Harris, cottage owner, Holbrook Island, Maine, April 2, 1945

“I believe seals should be dealt with as you would rats.”

Norman Olsen, fisherman, Cape Elizabeth, Maine, January 17, 1947

State of Maine Department of Sea and Shore Fisheries, Seal Damage Reports, 1947
(cited in Lelli and Harris 2006)

“Recent history indicates that man's impact upon marine mammals has ranged from what might be termed malign neglect to virtual genocide. These animals, including whales, porpoises, seals, sea otters, polar bears, manatees, and others, have only rarely benefited from our interest: they have been shot, blown up, clubbed to death, run down by boats, poisoned, and exposed to a multitude of other indignities, all in the interests of profit or recreation, with little or no consideration of the potential impact of these activities on the animal populations involved.”

US Congress Merchant Marine and Fisheries Committee Report 1971b: 11-12

Seal are ubiquitous in the Gulf of Maine. Today, two species breed along its shores while three species stray into but do not regularly breed in the area. Population counts of Harbor (*Phoca vitulina concolor*) and Gray (*Halichoerus grypus*) seals appear to document a marked and steady increase in the three decades since the passage of the Marine Mammal Protection Act. While the populations of other species found in this area – Harp (*Phoca groenlandica*), Hooded (*Cystophora cristata*) and Ringed (*Phoca hispida*) – appear to be stable or increasing in their home range, little is known about their numbers or life history within the Gulf of Maine. Just as seal populations have increased so too have coastal human populations.

While demographics of both seals and human populations have changed over the past century, many of the basic attitudes and values at the root of conflicts have remained. The relationship between seals and humans is complex, driven by a wide, sometimes conflicting range of attitudes and values, with extremes ranging from a sense of competition to an appreciation of seals as an important part of a richly diverse and healthy marine ecosystem. Conflicts, real and perceived, are nothing new and have resulted in a variety of both seal protection and seal bounty legislation in New England. In fact, local ordinances protecting seals, driven by a newly burgeoning tourist industry, were first enacted in Maine 100 years before the Marine Mammal Protection Act. However, seal bounties, driven by an early program of “ecosystem management” attempting to reduce predatory pressure of seals and restore depleted fish stocks, quickly replaced protective legislation.

The Marine Mammal Protection Act created a federal legislative basis for regulating marine mammal interactions in 1972. Not only did the Act seek to conserve and protect marine mammals but also it further states that their populations “... *should be protected and encouraged to develop to the greatest extent feasible commensurate with sound policies of resource management and that the primary objective of their management should be to maintain the health and stability of the marine ecosystem.*” While these objectives form a clear basis for restoring and protecting depleted populations they raise difficult problems when applied to stable or increasing populations. Defining the “greatest extent feasible” for population development as well as defining precise and measurable indicators of ecosystem health and stability are not trivial problems. While the lower limits of a population’s viability rest to a great extent on measurable biological indicators (i.e. population number, recruitment etc.), the upper extent of “feasible” population growth can rest on less easily defined, value weighted criteria (how many is “too many”). While the merits of this approach can be debated, these questions, real or perceived, have and continue to play an important role in discussions of expanding seal populations.

Meetings to address issues involving pinnipeds are not new. Since the passage of the MMPA there have been a number of meetings and workshops aimed at addressing or identifying questions and problems and identifying important areas for research. Recent interest and controversy surrounding seals in the northeast U.S. prompted the organization of this meeting.

Previous Seal Meetings in the Northeast

Marine Mammal Commission Meeting, 1979

In 1979 (Prescott *et al.* 1980) the Marine Mammal commission sponsored a multi-day workshop aimed at defining the research needed for a better understanding of cetaceans and pinnipeds along the US east and gulf coasts. This meeting drew more than 50 researchers and outlined the existing state of knowledge and needs for future study.

Pinnipeds in the Gulf of Maine: Status, Issues and Management, 1995

In 1995 the New England Aquarium in Boston, MA sponsored a two-day meeting titled “Pinnipeds in the Gulf of Maine, Status, Issues and Management.” Over 50 stakeholders attended the workshop with the stated goal of exploring the fundamental questions and issues that could lead to better management of human/seal conflicts in the Northeast. A broad range of participants included researchers, conservationists, and experts in animal welfare issues. Invited plenary speakers reviewed the existing state of knowledge and research and discussion groups identified important questions and research areas. A list of issues and research priorities (not ranked) was created. These findings (Mooney-Sues and Stone 1995) were used as a part of the WHOI 2009 workshop’s pre-workshop survey and formed a basis for workshop discussion.

Key findings and conclusions from the 1995 meeting:

1. Gray seal population appears to be increasing.
2. Harbor seal population appears to be increasing.
 - a. May be due to a local distribution shift (more data needed).
 - b. Some localized populations (Sable Island) in the western North Atlantic are in decline.
3. Conflicts existing between aquaculturists, traditional commercial fisheries and seals are important issues needing resolution.
 - a. Risk assessments and cost/benefit analysis are needed.
4. Public education and outreach initiatives need to be expanded given the growth in both human and seal populations. It is important that people understand how to deal with seal encounters to minimize risk to humans and seals.
5. The difference between "perceived" problems and "real" problems needs to be adequately conveyed to the general public.
6. There is a body of literature which states that seal populations periodically crash (Harwood and Hall 1990). Should we be implementing measures to control growing seal populations or is nature the best manager of nature?
7. Need to undertake an assessment of public attitudes and perceptions concerning pinnipeds.
8. Fisheries observer programs can be valuable in providing information on operational conflicts. There remains a need to overlay observer data with data from fishery registrations, knowledge of temporal and spatial fishery effort and fish population distribution and abundance.
9. Determine the accuracy and reliability of anecdotal reports about conflicts between pinnipeds and fisheries.
10. Improve relations and invest in collaborative efforts (researchers and fishing community, research and management in particular, with Canadian officials given that seals are a trans-boundary stock, etc.).
11. Improve and expand communications between all relevant interest groups to facilitate the sharing of known information and facts.

Important research needs cited in 1995 (not prioritized):

1. A full analysis of data already collected by various organizations throughout the region. It may be that more data have been gathered than scientists and managers are aware of, but information is

not being shared.

2. Standardize methods for collecting data and establish a clearinghouse to collate and disseminate information.
3. Improve population estimates and indicators of growth for all seal species with clearer distinctions made between localized populations and changes in overall populations
 - a. More regular and rigorous monitoring activities including aerial surveys, radio telemetry and use of appropriate adjustment factors.
4. Obtain population dynamics/life history data, especially for ice seals.
5. Information on breeding areas needs to be updated -- Are they changing?
6. Distribution: Are species ranges changing? Examine of the historical record for each species.
7. Long-term feeding studies including where, when and how seals choose prey, especially when they are faced with alternative species.
8. Estimates of energy requirements of seal species (stomach content analysis, i.e., estimates of tonnage of total fish consumed, stable isotopic analysis, etc.).
9. Health Assessment: monitoring of general health of seal populations is necessary - both baseline and future data relative to disease incidence and dynamics.
10. Determine success ratio of various deterrents on lobster pots and aquaculture pens.
11. Fuller understanding of resource economics.
12. Fuller understanding of the economic benefits to tourism industry.
13. Effects of development and tourism on seals and potential loss of habitat.
14. Public opinion trends: A clearer understanding of societal values and the role they play in management decisions that are made in the midst of scientific uncertainty (i.e., establish the "value" of seals to human society).
15. More information is needed on the ecological relationship between seals and target species (trophic interactions) of commercial fishers is needed.
16. While marine debris was not determined by the collective group to pose a significant threat to seal populations, loss from entanglement is symbolic of the larger disruption of aquatic food chains and energy flow patterns that occur when marine species are killed via interaction with debris as opposed to through natural predation. The group was in favor of efforts to maximally reduce man-made debris in the Gulf of Maine and agreed that future discussions about marine debris and its effect on pinniped populations may be warranted.

Meeting on Harbor seals of the Northeast (U.S.) region, 2002 and 2004

In 2004, the Maritime Aquarium at Norwalk sponsored a one-day meeting to outline a research program for seals in the Northeast Region. This meeting included a dozen pinniped researchers. This meeting was a follow-up of a similar meeting held in October of 2002. The first meeting was an attempt to establish a coordinated one-day coastal seal count. It was noted that the previous meeting was small, but had a positive outcome and could be a model for expanding and better coordinating seal research in the area. This meeting was called to identify and discuss important research areas.

Improving communication and sharing of information and difficulty in obtaining funding were the central reasons for this meeting. European, West coast and Canadian models were cited as

examples of successful research collaborations. The lack of a similar plan for the east coast of the US was also noted.

The Valentine's Day seal count was a positive outcome from the 2002 meeting. The areas agreed on to address in a regional framework included: abundance, food habits, movements, human interaction, stock structure, habitat use, predation, and disease/health assessment.

Recommendations and Research Priorities at the 2004 meeting:

1. Abundance: Determine spatial and temporal distribution, reproduction and rate of increase, perform regional census surveys, monitor index sites and identify carrying capacity of habitats.
2. Food Habits: There is a two-way trophic interaction on fish: removal by fisheries and removal by seals. Therefore, there is a need to know what the seals are eating (and within an expanded area of coverage) through stomach contents, scat analysis and fatty acid analysis. Need to determine prey sampling (techniques), distribution/ abundance of prey and distribution of prey by season.
3. Movements (relative to habitat features): Understand areas and time used for foraging, travel, resting, reproduction, diving behavior, site fidelity and movements related to weather, water and other environmental factors. (To be accomplished by) tagging of seals (flipper, radio, satellite).
4. Human Interaction: Disturbance of seals by boats, planes, dogs, construction, recreational users of the water and other noises. Determine effects: mortality, entanglement (not bycatch), habitat displacement and pollution.
5. Stock Structure: Meta-populations, genetics (one or more stocks?).
6. Habitat Use: Characterization, description (general patterns of use), movements – locally and regionally, interspecies competition between Gray and Harbor seals, intra-species competition (age, class & gender), site fidelity (yearly, seasonally), G.I.S. database and modeling.
7. Predation: Identify predators-sharks, coyotes, eagles, and gulls. Humans and domestic animals should be considered under "Human Interaction"
8. Disease / Health Assessment: Understand parasites (cod worm), persistent organic pollutants (mercury, PCBs, etc.), harmful algal blooms, anthropogenic (marine debris, etc.) - What is a healthy baseline?

An abbreviated version of these research priorities was used as a part of the pre-workshop survey used for the WHOI 2009 meeting.

Structuring a Novel Research Team to Define and Assess the Impact of Human/Seal Interactions on Cape Cod/Gulf of Maine through Ecosystem-Based Analysis, 2006

In December of 2006, the Chatham-based Cape Cod Commercial Hook Fishermen's Association (CCCHFA) took the lead in organizing a meeting between fishermen, policy makers, environmental organizations and researchers to create a unique partnership to study the New England seal population. This meeting was held concurrent with escalating concern between fishermen, a growing seal population, documentation of shark attacks and a letter submitted to Massachusetts Senators, calling for officials to act on the threats posed by seals.

The members of this meeting were to create a research team that would address important questions to define and assess the ecosystem role of seals by examining population dynamics, behavior, ecosystem function and health.

The following were the goals of the research team in the 2006 meeting:

1. Apply current technology and novel partnerships to build a better base of scientific understanding for New England pinnipeds.
2. Build mutual understanding and trust between stakeholder groups.
3. Disseminate progress and results.
4. Generate scientific basis to define “success” for pinniped policy in the region.

The ideas outlined in this meeting include understanding population dynamics, behavior, ecosystem function, baseline health, impacts of humans on seals, and seals on humans in regards to health, fisheries, and a changing environment.

This meeting resulted in a successful partnership, financially aided by the International Fund for Animal Welfare (**IFAW**), between fishermen and seal researchers, to form a cost-effective cooperative research agreement whereby seal researchers were provided boat transport around the Chatham and Monomoy area by local fishermen. The agreement allowed students and researchers to gain access to area off of Chatham, an area that would otherwise not be accessible and supported a collaborative effort to increase understanding and communication between user groups. Currently, funding is no longer available for this initiative, but the success of the program and the research outline created during this small meeting indicates the desire and need for a similar agreement to continue

Gulf of Maine Pinnipeds- populations, problems and priorities, WHOI 2009

Meeting Summary, Organization and Agenda:

The present workshop, funded by the Woods Hole Oceanographic Institution’s Marine Mammal Center (**WHOI MMC**), was held May 28 and 29, 2009 on WHOI’s Quissett campus in Woods Hole MA. The purpose of this meeting was to bring together representatives from key interest groups to identify and discuss issues concerning pinnipeds in the Gulf of Maine.

As there had not been a large meeting on the subject for over ten years, we wished to review the results previous meetings and see how issues may have changed and what progress may have been made in addressing them. We also wished to see what new issues have emerged in the past decade. Our hope was to address previous and current issues and note changes. Given the advances in technology since that last major seal meeting we also wished to see how new and emerging technology (telemetry, networking) might be used to better address the problems stated at this and previous meetings.

Our goals for the meeting were to:

1. Build community among stakeholders with an interest in pinnipeds in the region.
2. To identify issues surrounding pinnipeds living in the Gulf of Maine.
3. To formulate strategies and suggest tools for addressing important issues.

Despite the efforts of past meetings, no formal or informal meeting format currently exists to aid in ongoing collaboration, discussion and long- term communication of seal research and issues in the Northeast. Previous meetings have been held due to the action and interest of a variety of stakeholders and researchers. Recent meetings have emphasized the importance of broadening the base of participants. For this meeting, the organizers sought participants from the fishing community, pinniped researchers, regional marine research institutions, animal protection groups, the conservation community, and academics with experience in ethics, as well as managers of wildlife and federal and state regulators responsible for pinniped management.

Our purpose was to bring together representatives from key interest groups to facilitate sharing of information and perspectives that we hope will richly describe relevant issues and their various complexities. We also sought to use this meeting to provide perspective on the issues and challenges presented by pinniped populations in the northeast, improve communication among stakeholders and begin to develop tools to address the most pressing issues.

Over 60 invited speakers and participants spent two days presenting information and discussing topics. There were 21 presentations grouped into three subject areas: population, disease/health and human impact. These short presentations (15 minutes each) were followed by a general open discussion. The second day of the workshop consisted of two working sessions and a general discussion session. Participants were asked to sign up for one of these discussion groups that were divided up into the three theme areas. A chairperson moderated the groups and rapporteurs were designated to record discussions.

In an effort to build on past meetings, we created an on-line survey that was distributed to a mailing list of registrants and interested stakeholders. This survey was created using findings from previous meetings and was designed to help prioritize these findings. It was hoped that this survey would guide and stimulate discussion. We also conducted a post-workshop survey to gauge the success of our meeting.

To encourage ongoing communication we also created an on-line discussion group – “Gulf of Maine Pinnipeds” within the scientific networking site “ResearchGate”. All attendees were given instructions on how to sign onto the site (attached in the Appendix) and encouraged to join. References and copies of presentations provided by speakers were posted on this site.

The organizers of this meeting developed the workshop agenda based on current issues. Topics fell into three categories: population, disease/health and human impact. While many more issues could be addressed, the final schedule was designed to fulfill the needs of people interested in presenting and the overall interest of those attending.

Speakers were invited from Canada and the U.S. representing parties with an interest in pinnipeds including individuals from federal, state, private, and nonprofit organizations representing fishermen, biologists, naturalists and animal welfare. The keynote speaker, Nell (Cornelia) den Heyer, presented background on the long term studies and state of the art research being conducted by seal biologists in Canada in the lab of Dr. Don Bowen.

The second day of the workshop was dedicated to fostering communication between smaller working groups. The chairs of each session structured discussion to address relevant questions with the direction of each working group determined by the participants.

The summary session incorporated the summary points of each working group as well as that of the meeting chair. The summary of each session is presented below with an edited transcript of each session and the general meeting in the appendix of this report.

Workshop Agenda

Day 1- Thursday May 28th 2009 WHOI Quissett Campus, Clark Bldg 507

morning session

Time	Presenter	Topic
8:30	9:00 Greg Early	Opening - welcome
Seal Population Biology		
9:00	9:15 Jim Gilbert	Harbor seals in the Gulf of Maine
9:15	9:30 Stephanie Wood	U.S. Gray Seal (<i>Halichoerus grypus</i>) Recolonization: Status and Stock Structure
9:30	9:45 Diane Kopec	Harbor seal prey selection in the Gulf of Maine
9:45	10:00 Kristen Ampela	The diet of gray seals (<i>Halichoerus grypus</i>) in United States waters, as inferred from analysis of hard parts and fatty acids
10:00	10:15	break (15 minutes)
10:15	10:30 Gordon Waring	Overview of the Northeast Fisheries Science Center Seal Research Program
10:30	10:45 Rob DiGiovanni	Harbor Seal (<i>Phoca vitulina</i>) and Gray seal (<i>Halichoerus grypus</i>) movements in New York and Gulf of Maine
10:45	11:00 Gregory Skomal	White shark predation and the implications of increasing pinniped populations
Disease and Health		
11:00	11:15 Sea Rogers Williams	Otitis Externa & Otitis Media in Phocids
11:15	11:30 Hendrik Nollens	Viruses and Seals- TBA
11:30	12:00	lunch (30 minutes)
KEYNOTE	12:00	1:00 Cornelia den Hever The ecology of Sable Island Grey Seal, <i>Halichoerus grypus</i> , population

afternoon session

Disease and Health (continued)		
1:15	1:30 Ole Nielsen	An Overview of Emerging Infectious Diseases in Marine Mammals with Emphasis on the Lessons Learned from the 2006 Distemper Outbreak in the Gulf of Maine Seals
1:30	1:45 Lena Measures	Marine mammal disease management (or NOT)
1:45	2:00 David Rotstein	Pathology of NE Pinnipeds-Greatest Hits From One Hit Wonders to Perennial Favorites: Pinniped cases in the northeast
Humans and Seals		
2:00	2:15 David Lavigne	The cultural nature of seal-fisheries conflicts
2:15	2:30	break (15 minutes)
2:30	2:45 Greg Early	What are seals doing in the Gulf of Maine?
2:45	3:00 Marcy Nelson	Interactions Between Harbor Seals and Atlantic Salmon Aquaculture In Maine
3:00	3:15 Peter Corkeron	Seals, models, and ecosystem-based fishery management: the big picture
3:15	3:30 Owen Nichols	Perspectives on seal interactions with Cape Cod commercial fisheries: Localized depredation or large-scale competition?
3:30	3:45	break (15 minutes)
3:45	4:00 CT Harry	Pinniped Entanglement and Disentanglement on Cape Cod, Massachusetts
4:00	4:15 Mendy Garron	Pinniped Stranding Response and Rehabilitation in the NER-More questions than answers
4:15	4:30 Amy Sierra Van Atten	The Northeast Fisheries Observer Program Overview of Data Collection and Biological Sampling
4:30	4:45 Sharon Young	Seals: Beauty and the Beast
5:00	7:00	reception

Workshop Agenda, Day 2- Friday May 29th 2009 WHOI Quissett Campus, Clark Bldg 507

Time	Topic	
8:00 8:30	Coffee and light breakfast	
8:30 9:15	Group Meeting/discussion	
9:30 11:30	Working groups	
12:00 1:00	Lunch (provided)	
1:15 2:15	Working group discussion	
2:15 2:30	Break	
2:30 3:30	General meeting, working group reports and close	

Summary of Group Meeting, Discussion and Charges to Working Groups

Before breaking into working groups, attendees met in a general session. During roughly one hour of open question and answer, attendees discussed Canadian and U.S. perspectives (trans-boundary issues) as well as questions of how the results of this workshop would be used. An edited transcript of this Q&A can be found appended to this report.

The results of the Pre-Workshop on-line survey were presented and briefly discussed. The survey indicated a strong preference by this group for scientific research and the strong feeling that funding was a primary impediment. The survey showed that attendees felt that issues could be approached in a number of ways and that communication and collaborative effort were singly important. Strategic approaches considered in the survey were: research, education, advocacy and legal. The full survey and results are attached to this report in the Appendix.

The working groups were asked to begin by generally discussing their respective topic areas. They were then asked to narrow the focus of their discussions to identify and articulate specific strategies for meeting the goals of this meeting: building community among researchers and stakeholders, identifying “high priority” issues or problems and formulate specific strategies and tools for addressing those issues. They were asked to specifically address issues of funding, networking and data sharing. They were asked to try to match a strategy to the issue or problem.

Summary of Working group Sessions

Population Dynamics:

Chair- Dr. Jim Gilbert (University of Maine, Orono)

The key issues identified by the Population Dynamics Working Group are (listed in order of descending importance):

- A. Abundance
- B. Long term studies on individuals: branding, ecological parameters.
- C. Food habits and distribution – location of foraging areas and seasonal movements.
- D. Fisheries interactions
- E. Stock structure

1. **Abundance and Long Term Studies-** Determining accurate counts of harbor and gray seals to establish population numbers requires adequate surveys. Recommendations to fulfill this need include surveying through all seasons and wider geographic range. The group recommended that there should be coordinated survey efforts between regions in the U.S. and Canada, including efforts with fishermen, to determine whether new pupping sites exist. To determine accurate population dynamics more information needs to go from pup production to population estimates. Concern exists that not all pupping sites are being surveyed as well as surveys not being conducted outside of pupping season. A need to establish accurate correction factors on time in and out of water (foraging, transit) was also a concern and priority. This would give a more representative number of animals present. Methods on individual tagging and assessment were addressed including satellite tags, flipper tags, branding, animal handling and re-sighting.
2. **Food Habit and Distribution-** Methods of gathering information on diet and distribution were discussed including fatty acid analysis and use of by-catch. Issues and concerns on cost, sampling and feasibility were addressed. Coordinating efforts was recommended as a means to validate food habits including multiple methods such as scat/fatty acid analysis from current and on-going opportunities to sample.
3. **Fisheries interactions and Stock Structure-** Fishery interactions were addressed as indirect and direct. Neck wrap entanglements in juvenile gray seals are common, but not in harbor seals. Discussion on the reason for this phenomena included type of gear, lack of pressure or concern (management) and possible competition with fisheries. Biases in fishing data and diet analysis need to be addressed as well as near shore and offshore feeding habits. Recommendations to collect more data on feeding habits were made. Whether seals are in competition with fisheries is a science and perception problem and needs to be addressed from multiple perspectives. Determining what seals do not eat is just as important as determining what they do. Education and advocacy with recreational fishermen can be a way to gather more information. Indirect interactions also include

transmission of disease, parasite and contaminants. Regular monitoring for these effects also needs to occur.

4. **Data sharing and Communication-** The group also discussed how to improve communication and data sharing. Recommendations to inventory data, make data accessible through password protected sharing, create usable databases of information were discussed. Comments included modeling a seal network after other models such as the Pacific Consortium, the Right Whale Consortium, WhaleNet and **GoMOOS** (Gulf of Maine Ocean Observation System). The meeting was critiqued as well with the recommendation that future meetings be frequent and would be more effective than virtual meetings, possibly every two years, with fewer talks and more posters.

The population dynamic group produced a current research plan of scheduled surveys and future steps:

Current Planned Research:

<u>Year</u>	<u>Goal</u>
2009	Abundance/Pup Production/Growth Trajectory harbor seal and gray seal Current Research: Dec to Feb- harbor seal and gray seal abundance surveys
2010	Abundance counts – repeat 2001 aerial surveys for harbor seals along the Maine coast Live and dead collection for correction factors

Recommendations and Future steps:

1. Abundance and Long Term Studies- Long term studies on population structure are needed for harbor and gray seals. Increase survey seasonality and geographic range.
2. Food Habits and Distribution- Coordinate sampling efforts to determine dietary habits.
3. Fishery Interactions and Stock Structure- Determine science behind interactions increase documentation of interactions through multiple perspectives.
4. Determine issues and who is interested in tackling these issues.
5. Determine a budget for each of these priorities.
6. Find Funding.

Human and Fishery Interactions

Chair- Owen Nichols (Provincetown Center for Coastal Studies/ School for Marine Science and Technology – University of Massachusetts - Dartmouth)

The human interaction working group was initially tasked by its chair to designate topics for discussion, but first engaged in discussion of relative population size and increase and shifting baselines, due to an increasing public perception of local seal ‘overabundance.’ Several participants pointed out that while numbers of seals in the Gulf have increased in recent decades, their populations were extirpated from the area by humans, and are presently re-colonizing areas of former abundance that are now occupied by far greater human presence. The lack of historical data and possible means of establishing baseline abundance were discussed. Consensus was reached that seal and human populations in the Gulf are currently increasing, as is the potential for human interaction. The topics discussed in detail were marine debris, ecotourism, and fisheries interactions, with ancillary discussions of beach interactions and stranding response. The discussion of fisheries interactions was limited to operational interactions (seal depredation of catch retained in fixed fishing gear and entanglement/by catch of seals in gear), while ecological interactions (competition between seals and fishing operations) were deemed too broad a topic given the scarcity of data. It was noted that climate change, pollution, and ocean noise were also large-scale forms of human interaction and too broad for discussion in this forum, despite their potential for drastic impact on seal populations. It was also noted that human perception and cultural issues play a role in all of the above issues. The group closed with a discussion of education and outreach related to the topics discussed. Regardless of topic, over-arching recommendations were to improve inter/intra-agency communication/collaboration and to expand outreach to all stakeholders. The working group developed numerous topic-specific recommendations, summarized below:

Marine Debris:

1. Explore legal definition of derelict/ghost gear and seek means to allow fishermen to retrieve gear without risk of penalty.
2. Mine existing data on distribution and abundance of debris and ghost gear, and develop survey and reporting protocols.

Ecotourism:

3. Conduct research on the impact of commercial seal watch operations on seal populations and communities in the Gulf, based on similar studies from other regions (e. g. Alaska, California).
4. Continue to develop education and outreach efforts using responsible wildlife watching publications and whale watching as models. Target outreach toward individuals operating small boats, boat launch ramps, harbormasters.

5. Work with local, state and federal law enforcement agencies to enhance enforcement of Marine Mammal Protection Act and provide public opportunity to report violations.

Fisheries Interactions:

6. Research methods to deter depredation in aquaculture ventures and commercial and recreational fisheries (e.g. acoustic deterrents, gear modifications), which is related to bycatch/entanglement as well. Review existing data on pinniped hearing and efficacy of acoustic deterrents and define data gaps for Gulf of Maine species.
7. Need to find means of navigating legislation and (experimental fishing and research) permitting process to facilitate the above.
8. Quantify the extent of depredation via cooperative research with fishermen and mining of existing observer and sector monitoring data, and conduct anonymous surveys of industry to better define bycatch/entanglement issues.
9. Form working groups and convene workshops involving fishing industry and scientists to focus on depredation and bycatch/entanglement.
10. Incorporate existing research into aquaculture facility site selection and management practices.
11. Explore means to permit fishermen to document and disentangle individual seals.
12. Expand outreach to fishing industry, perhaps in the form of a ‘traveling roadshow’ in which scientists reach out to the fishing community.

Disease and Health

Chair- Dr. C. Rogers Williams (National Marine Life Center)

The disease and health working group was initially prompted by its chair to list their main areas of concern and to list the top 10 diseases of Gulf of Maine seals. The areas of primary concern included population input of morbillivirus, diseases of national security and food safety concern, ocean health, animal welfare, natural history (of disease and pinnipeds) and the need of an epidemiologist in further discussions. The top diseases of concern were: (1) morbillivirus, (2) influenza, (3) rabies, (4) leptospirosis, (5) herpes, (6) toxoplasmosis, (7) pox, (8) lung worms, (9) *Vibrio spp.* and (10) harmful algal bloom toxins (HABs). Discussion quickly turned to the utility of such a list without knowing the baseline in the population to establish these diseases as a priority as well as the treatment or further direction if these diseases are known to be present in the animals studied.

Comments on the resources available for disease testing, screening, communication, and reporting were addressed. Several topics of discussions were brought forth, including the association between marine and terrestrial disease and surveillance, the idea of healthy vs. compromised individuals (by-catch, stranded, live, hunted), data collection and dissemination, as well as concrete solutions to address these issues. The recommendations and suggestions addressed represent both Canadian and U.S. priorities.

The recommendations of this working group are as follows:

1. Establish Baselines- The first priority of the group was unanimously defined as the lack of data and background on 'normal.' This includes the need for establishing basic health parameters, prevalence of disease in healthy individuals/ populations and parameters to compare animals in different conditions (bycatch, stranded, live, hunted).
2. Create a pool of funds to be used for diagnostics- The second priority addresses the main area of concern to all – funding. The idea presented was that each organization would contribute a set amount of funds to a central pool at the beginning of the year, to allow analysis and understanding the disease prevalence and health baselines, with the goal of obtaining a sample size of $n=30$ between all organizations for the given criteria (30 gray seals or 30 female juvenile gray seals, etc.). Samples would be submitted to a central location and pre-chosen disease screening facilities by each organization. In this way, a useful, central, accessible, statistically robust, dataset would be obtained with data owned by all parties involved held in a central consortium. This method would aid in long term monitoring and create reliable standardized parameters and data accessible by all.
3. Improve the speed of Unusual Mortality Event (UME) response- This priority includes criteria, declaration time, and funds available with the concern that by the time the UME is declared, the event is over. This was a main concern especially in terms of the 2004 and 2006 UMEs. There is a need to know which labs to rely on for diseases testing immediately. The general consensus was that there is too much money spent during these events with not enough resulting information. One way to manage this issue is to establish funds ahead of time and during a UME and designate a 'gatekeeper' to send target

samples. This person should be given the opportunity to conduct this task as their sole (or at least primary) responsibility. A manual should be created to establish standardized sampling protocol across networks (live and dead animals, researchers, stranding network members, aquaria, observer program/bycatch) and communication between regions is essential (local, national, international).

4. Collect ALL samples in standardized fashion based off of above-mentioned resources. Establish NOAA recommended labs for disease screening with the aid and direction of an epidemiologist.
5. Establish when animals should NOT be released back into wild, as in cases of morbillivirus, influenza, etc.
6. Establish baseline through live capture research opportunities. There is a need to increase collaboration between human health and marine researchers, make more of permits and research during live captures, take the opportunity to collect blood/samples, and contact others (Canada- DFO, Scotland-SMRU) about health assessments protocol and ideas with an increase in international cooperation for multiple projects. This priority would help to address rehabilitation and release protocols as well.
7. Establishment of Northeast Marine Mammal Health Consortium. The consortium would be a data center primarily providing access to resources and databases. Datasets can be managed through a password protected (agreement) manner. Secondly, it can be a center for sample storage and dissemination. Suggested that WHOI could and would take on this role.
8. Need to improve on and create a network to increase communication between regions (local, national and international).
9. Need a lead representative to establish collaborations and write grants.

Overall Meeting Summary and Recommendations

Ongoing issues – As shown by historical documentation and as mentioned by several attendees (who have attended one or more previous meetings about pinnipeds in the Gulf of Maine) many issues are not “new.” For example, the impact of seals on fishing and the impact of fishing on seals is a recurring issue and a constant in the area. In many cases there are no absolute “answers” for these questions and no single bit of research will provide the data to “solve” the problem. In some cases these are simply issues to be monitored using the best and most efficient means of data gathering and sharing. In some cases, however, these may be questions that cannot be fully resolved with a single strategy. Attendees noted in their survey responses that different issues require different approaches and may require the combined and coordinated efforts of researchers, managers and advocates. A holistic approach to these issues seems most warranted.

Whether addressing a complex issue or monitoring an ongoing issue, communication and data sharing (particularly when funding is limited) would appear to be the most basic need. Attendees noted the importance of collaboration and communication repeatedly and always placed a high priority on even the most simple and basic means of “staying in touch.”

Emerging Issues - Emerging issues are quite frequently the driving force behind specific research or management efforts. These issues, however, may not result in long-term research efforts, and their importance can dim over time. For example, a high priority issue in 1995 was seal/aquaculture conflicts along the coast of Maine. This resulted in a special working group (NMFS 1996) and research efforts. In the survey for this meeting, however, attendees did not consider this issue of high importance.

During this meeting several emerging issues were brought up by attendees. For example, sound and the impact of anthropogenic noise in the marine environment was noted as an emerging issue that, while important, could not be considered to its full extent in this general meeting. While most attendees that responded to the post-meeting survey thought that the format used for this meeting was useful, it is likely that specialized issues will require special attention that cannot be managed in such a general format. For this reason, it seems that emerging issues be considered for a different format of discussion and development. Given that these may require fast action, a small format, or on-line meeting and discussion would seem to be appropriate. While this again reinforces the general need for good communication, it emphasizes that there should be different means of communication to better suit the type of issue to be addressed.

Conclusions

In attempting to identify, describe and discuss a full range of issues and problems surrounding pinnipeds in the Gulf of Maine, workshop attendees produced a dizzying array of old and new issues. There is little doubt that trying to find a foothold to address these questions could prove daunting. As stated by one attendee in the on-line survey:

“public perceptions and attitudes directly and indirectly impact the funding and the coordinated effort directly impacts the funding sources and coordination for the scientific data. If the

perception and funding change the legal framework could also change; and vice versa. What a twisted web we weave when we don't address it as one great picture"

Still, there are areas of common agreement and common need. Whether it proves best to address the “great picture” as a whole or in small increments, communication would seem to be the most critical need, either to organize, plan and fund large-scale, well coordinated and designed studies, or to maintain contact and continuity among individuals doing specialized smaller scale projects. Therefore, we consider improving communication the highest priority.

In all working groups, as well as in general discussions and surveys, attendees pointed out the importance of enhancing communication. This could include regular general “discussion” based meetings as well as specialized working groups to address specific problems or emerging issues. The need for community, continuity and network building appears to be critical.

The pre-workshop survey indicated that attendees, by and large, viewed research as the most valuable tool and a lack of data a critical problem. This may reflect a bias in the assembled group, but attendees also indicated that various strategies might be needed for addressing different issues. Not all issues could best be addressed by research alone.

This is reflected in many comments about the need to work with other stakeholders to form and improve working relationships.

Attendees pointed out and discussions reinforced the importance of using an appropriate strategy for addressing issues. While some issues may be primarily addressed as a research questions, others may require a complex strategy involving research, legal and advocacy efforts.

Funding was strongly and repeatedly identified as the most important limiting factor. This seems to reinforce the importance of collaborative efforts to both make best use of limited funds and maximize the utility of results. This would include data sharing, and the development of inexpensive and widely applicable tools.

Finally, each working group developed detailed and extensive lists of important issue and questions. While we have not tried to prioritize all of these results, given the above it seems that areas of crosscutting research to shed light on questions of the limits of expanding populations would seem to take high priority. For example, the study of disease in seal populations can be useful for better understanding the overall health of the population and understanding natural limits to population growth. Furthermore, disease study could better indicate risk and impact by seals on human health and activity.

Therefore, although it was not the objective of this workshop to prioritize research of issue areas, we suggest that highest priority be given to areas of research and projects that are best addressed by research, that are “cross cutting” the areas of seal populations, disease and human impact – and are addressable within a limited funding environment.

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APPENDIX

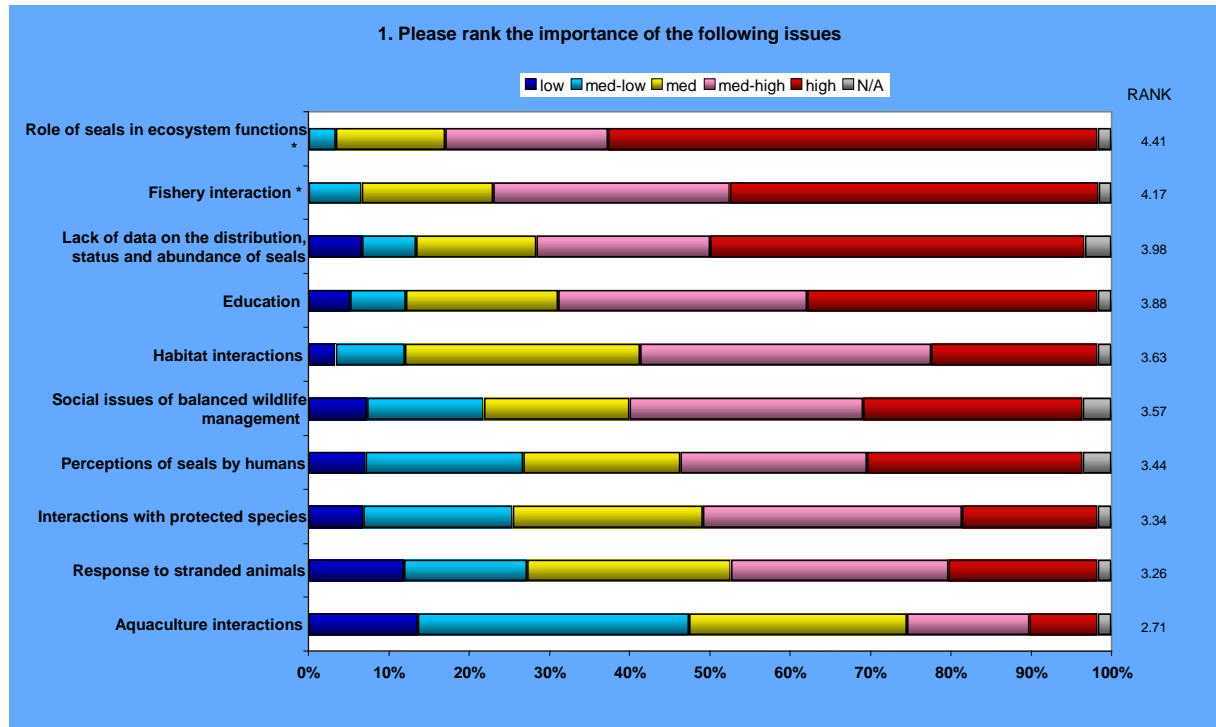
Pre Workshop Survey

The following are the results of a survey conducted from 5/1/09 - 5/18/09. Sixty-two participants took the survey with fifty-seven completing all questions (91.9%). There were seven questions in the survey. Five questions asked participants to rank lists of issues, research areas, impediments and utility of tools from low to high. One question was a matrix that participants could answer with multiple answers. One question required a yes/no answer. The five ranking questions were scored by assigning a numerical value to each rank – with 1 point for low, 2 for medium low, 3 for medium, 4 for medium high and 5 for high. Results were tabulated by percentage of total score. The lists are shown in descending order of average rank. The predominance or “spread” of results was demonstrated by calculating standard deviation (**SD**) as an indicator of consensus (higher SD = more weight on a single rank = agreement).

1. Please rank the importance of the following issues:

In June of 1995, 57 researchers and stakeholders met at the New England Aquarium in Boston to discuss pinniped populations in the Gulf of Maine. This meeting identified over one hundred issues relating to pinnipeds. The following were the issues that ranked the highest in importance in a computer facilitated working session. These are not listed in a priority order.

In 2006, stakeholder groups met on Cape Cod to define and assess the impact of human/seal interactions on Cape Cod. That meeting also identified a range of research priorities. These are indicated in the following lists by an “*”.



1. Please rank the importance of the following issues									
answered question					62				
skipped question					0				
	1 low	2 med-low	3 medium	4 med-high	5 high	0 N/A	Rating	N	stdev
Role of seals in ecosystem functions *	0.00%	3.40%	13.60%	20.30%	61.00%	1.70%	4.41	59	23%
Fishery interaction *	0.00%	6.60%	16.40%	29.50%	45.90%	1.60%	4.17	61	18%
Lack of data on the distribution, status and abundance of seals	6.70%	6.70%	15.00%	21.70%	46.70%	3.30%	3.98	60	16%
Education	5.20%	6.90%	19.00%	31.00%	36.20%	1.70%	3.88	58	14%
Habitat interactions	3.40%	8.60%	29.30%	36.20%	20.70%	1.70%	3.63	58	14%
Social issues of balanced wildlife management	7.30%	14.50%	18.20%	29.10%	27.30%	3.60%	3.57	55	10%
Perceptions of seals by humans	7.10%	19.60%	19.60%	23.20%	26.80%	3.60%	3.44	56	9%
Interactions with protected species	6.80%	18.60%	23.70%	32.20%	16.90%	1.70%	3.34	59	11%
Response to stranded animals	11.90%	15.30%	25.40%	27.10%	18.60%	1.70%	3.26	59	9%
Aquaculture interactions	13.60%	33.90%	27.10%	15.30%	8.50%	1.70%	2.71	59	12%

Results: The results showed a rather wide range in the perceived importance of the listed issues. The highest ranked issue was “Role of seals in Ecosystem Functions” (medium high) and the lowest was “Aquaculture interactions” (medium-low). For the top two issues, “Role of seals” and “Fishery interactions,” no respondent considered these issues “low” importance. All other issues showed a spread of opinions ranging from high to low. A “high” rank predominated in the first three issues: “Role of seals,” “Fishery Interaction” and “Lack of data on the distribution, status and abundance of seals.” “Education” was ranked as “high” importance more than any other rank.

“Habitat Interactions,” Social issues of balanced wildlife management” and “Perceptions of seals by humans” cluster lower with more respondents ranking them as “medium” importance. “Interactions with protected species,” “Response to stranded animals” and “Aquaculture” rank lowest – in this order – and were more frequently ranked as of low importance.

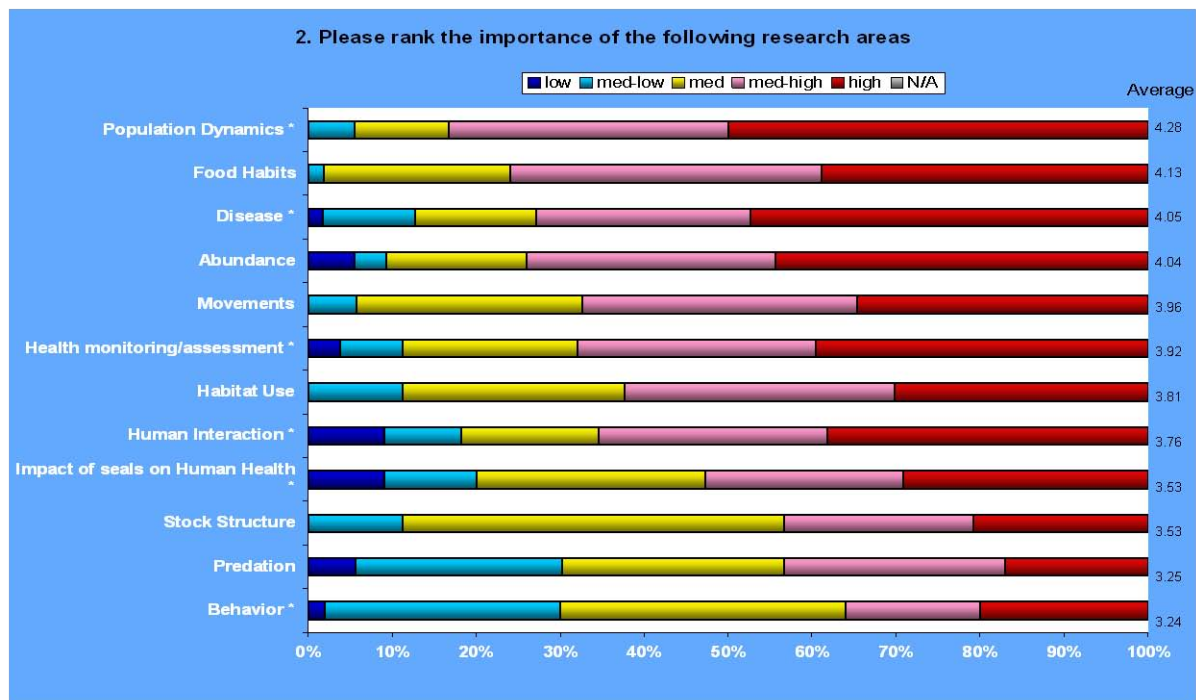
This pattern seems to show that neither “Role of seals” nor “Fishery Interactions” were considered of low importance and they are considered more consistently important by more respondents than other issues. The other issues show a rather uniform gradual decline in importance, with only “Aquaculture” far below others. This is interesting considering that in one of the original workshops generating this list (NEAq 1995), aquaculture interactions were considered of primary importance.

Conclusions: “Role of seals in Ecosystem Functions” and “Fishery Interactions” ranked highest in priority with more agreement that these issues are of moderately to high importance. Conversely “Aquaculture” issues were ranked lowest with the greatest percentage of respondents ranking this issue “low”.

2. Please rank the importance of the following research areas:

In November 2004 a group of researchers and stakeholders met at the Maritime Aquarium at Norwalk CT to discuss research priorities for pinnipeds. The following were listed as important components of a research plan.

In 2006, stakeholder groups met on Cape Cod to define and assess the impact of human/seal interactions on Cape Cod. That meeting identified a range of research priorities. These are indicated in the following lists by an*

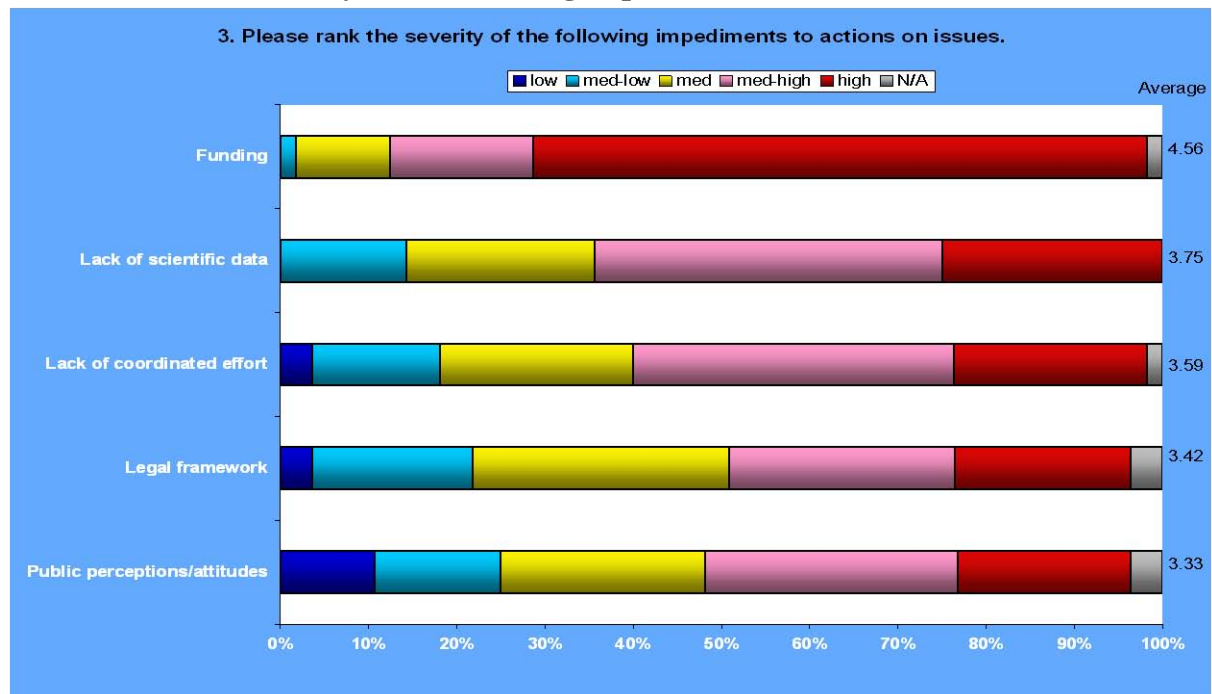


2. Please rank the importance of the following research areas									
answered question 56									
skipped question 6									
	1	2	3	4	5	0	Rating	N	stdev
	low	med-low	medium	med-high	high	N/A			
Population Dynamics *	0.00%	5.60%	11.10%	33.30%	50.00%	0.00%	4.28	54	20%
Food Habits	0.00%	1.90%	22.20%	37.00%	38.90%	0.00%	4.13	54	19%
Disease *	1.80%	10.90%	14.50%	25.50%	47.30%	0.00%	4.05	55	18%
Abundance	5.60%	3.70%	16.70%	29.60%	44.40%	0.00%	4.04	54	17%
Movements	0.00%	5.80%	26.90%	32.70%	34.60%	0.00%	3.96	52	16%
Health monitoring/assessment *	3.80%	7.50%	20.80%	28.30%	39.60%	0.00%	3.92	53	16%
Habitat Use	0.00%	11.30%	26.40%	32.10%	30.20%	0.00%	3.81	53	15%
Human Interaction *	9.10%	9.10%	16.40%	27.30%	38.20%	0.00%	3.76	55	14%
Stock Structure	0.00%	11.30%	45.30%	22.60%	20.80%	0.00%	3.53	53	17%
Impact of seals on Human Health *	9.10%	10.90%	27.30%	23.60%	29.10%	0.00%	3.53	55	12%
Predation	5.70%	24.50%	26.40%	26.40%	17.00%	0.00%	3.25	53	11%
Behavior *	2.00%	28.00%	34.00%	16.00%	20.00%	0.00%	3.24	50	14%

Results: Respondents ranked these research areas across a small range from “moderately high” importance to “moderately” important. This would seem to indicate that respondents felt that all research areas were generally important. There was somewhat greater consensus that “Population Dynamics” was of “high” interest. “Disease” was also ranked “high” by 47% of respondents; however this is balanced by 11% of respondents that scored this research area as “low” importance.

Conclusions: No general agreement on “high” research areas, but a general indication that all of the listed research areas were of some importance. Greatest disagreement (greatest “high” and “low” responses) were for the research areas “Human Interaction” and “Impacts on Human Health.”

3. Please rank the severity of the following impediments to action on issues.

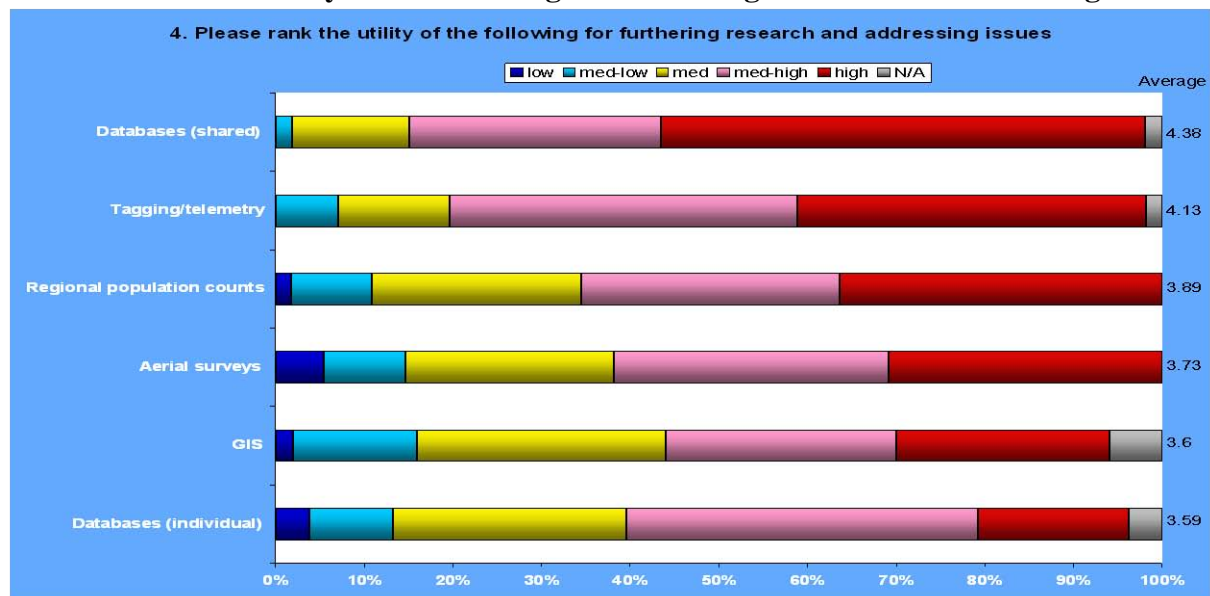


3. Please rank the severity of the following impediments to action on issues									
answered question				56					
skipped question				6					
	1 low	2 med-low	3 medium	4 med-high	5 high	0 N/A	Rating	N	stdev
Funding	0.00%	1.80%	10.70%	16.10%	69.60%	1.80%	4.56	56	27%
Lack of scientific data	0.00%	14.30%	21.40%	39.30%	25.00%	0.00%	3.75	56	15%
Lack of coordinated effort	3.60%	14.50%	21.80%	36.40%	21.80%	1.80%	3.59	55	13%
Legal framework	3.60%	18.20%	29.10%	25.50%	20.00%	3.60%	3.42	55	11%
Public perceptions/attitudes	10.70%	14.30%	23.20%	28.60%	19.60%	3.60%	3.33	56	9%

Results: The highest rating and greatest agreement on any questions or issue was that “Funding” is a severe impediment to further action. The other impediments were scored on average as “moderate” and all had similar percentages of “high” responses. Other than “Funding,” the ranks were determined by the number of “low” and “moderate” scores. “Public Attitudes” had the greatest divergence and the greatest number of “low” responses.

Conclusions: Funding appears to be considered the greatest impediment by the greatest number of those answering these questions. The greatest divergence of opinion is regarding the impact of public attitudes and opinion.

4. Please rank the utility of the following for furthering research and addressing issues:

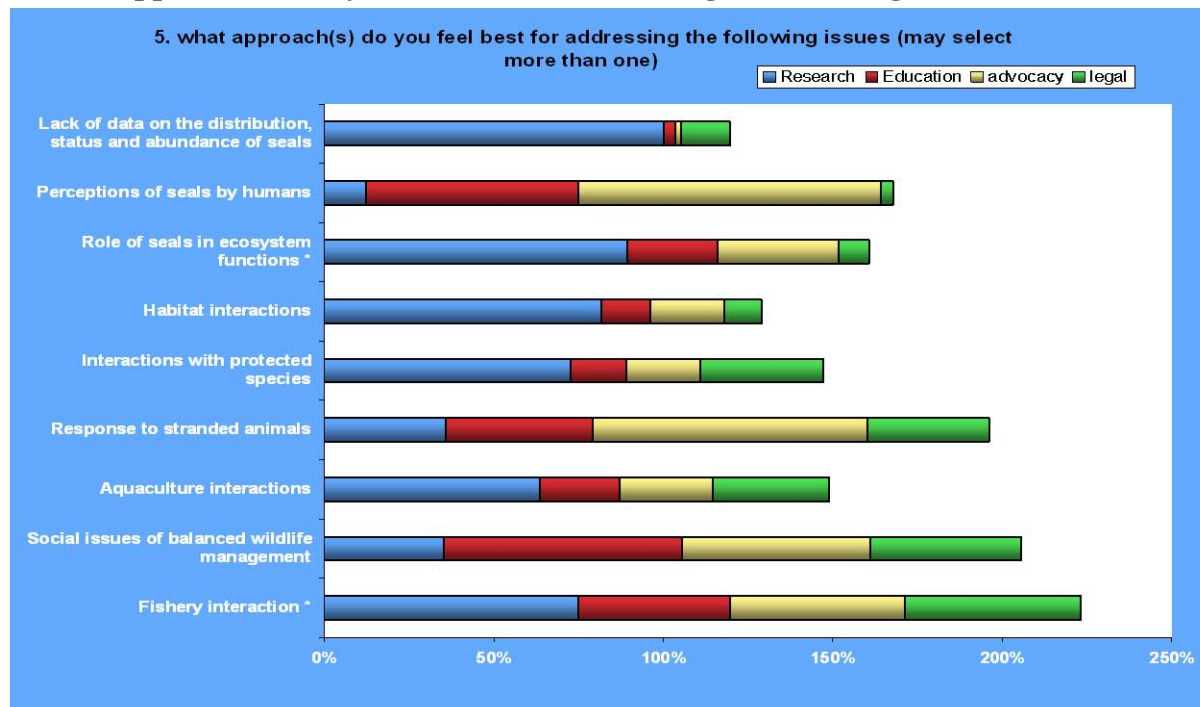


4. Please rank the utility of the following for furthering research and addressing issues									
answered question		57							
skipped question		5							
	1 low	2 med-low	3 medium	4 med-high	5 high	0 N/A	Rating	N	stdev
Databases (shared)	0.00%	1.90%	13.20%	28.30%	54.70%	1.90%	4.38	53	21%
Tagging/telemetry	0.00%	7.10%	12.50%	39.30%	39.30%	1.80%	4.13	56	18%
Regional population counts	1.80%	9.10%	23.60%	29.10%	36.40%	0.00%	3.89	55	15%
Aerial surveys	5.50%	9.10%	23.60%	30.90%	30.90%	0.00%	3.73	55	14%
GIS	2.00%	14.00%	28.00%	26.00%	24.00%	6.00%	3.6	50	11%
Databases (individual)	3.80%	9.40%	26.40%	39.60%	17.00%	3.80%	3.59	53	14%

Results: As with the previous questions there is a small difference in ranking of all answers – from “moderately high important” to slightly above “moderate importance.” Neither shared data nor telemetry was considered of “low” importance and these two research tools had the greatest percentage of “high” votes.

Conclusion: There is greater agreement that shared databases and telemetry are useful research tools than other methods. On average, however all are considered at least moderately useful.

5. What approach(es) do you feel best for addressing the following issues?

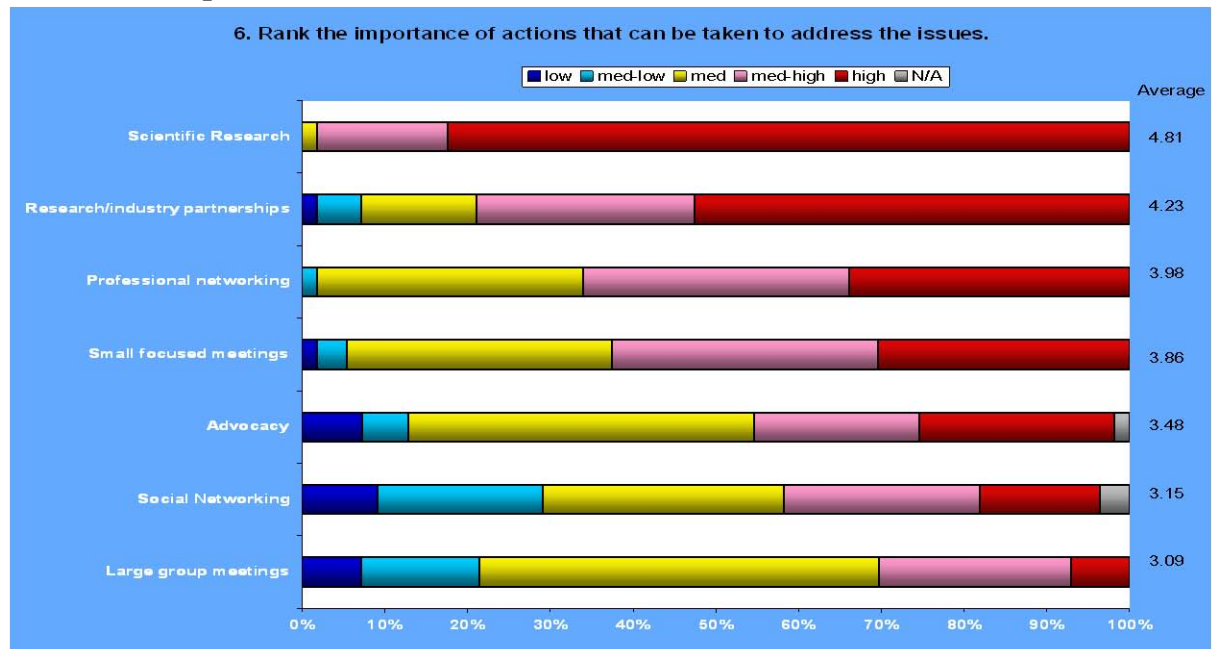


5. what approach(s) do you feel best for addressing the following issues (may select more than one)						
	answered question				56	
	skipped question				6	
	Research	Education	advocacy	legal	N	stdev
Lack of data on the distribution, status and abundance of seals	100.00%	3.60%	1.80%	14.30%	56	47%
Perceptions of seals by humans	12.50%	62.50%	89.30%	3.60%	56	41%
Role of seals in ecosystem functions *	89.30%	26.80%	35.70%	8.90%	56	35%
Habitat interactions	81.80%	14.50%	21.80%	10.90%	55	33%
Interactions with protected species	72.70%	16.40%	21.80%	36.40%	55	25%
Response to stranded animals	35.80%	43.40%	81.10%	35.80%	53	22%
Aquaculture interactions	63.60%	23.60%	27.30%	34.50%	55	18%
Social issues of balanced wildlife management	35.20%	70.40%	55.60%	44.40%	54	15%
Fishery interaction *	75.00%	44.60%	51.80%	51.80%	56	13%
average	62.88%	33.98%	42.91%	26.73%		

Results: This question was structured in such a way that respondents could provide multiple answers for each category. Therefore results are listed as a percentage of responses for each category and may total greater than 100%. The table above is ranked by standard deviation as an indicator of the “spread” of results. The greater the deviation, the more predominant one answer will be, and the greater consensus around one category. The results have a wide range of deviation. The issue “Lack of data on the distribution, status and abundance of seals” was cited by 100% of those answering this question as a “research” issue with little other approach. Other issues show a preference for one or two approaches - “Perception of seals by humans” is cited as predominantly (90%) an “Advocacy” and “Education”(62%) issue. Likewise, “Response to stranded animals” is predominated by “Advocacy”. And some issues such as “Fishery interaction” is listed as best addressed by a balanced of all approaches listed. Issues best addressed by “education and “advocacy” include “Social issues of Balanced wildlife management,” “Perceptions of seals” and “Response to stranding.”

Conclusion: Some issues appear to be best addressed by a single approach (i.e. “Lack of data on distribution” as a purely “research project). Others by several approaches (i.e. “Perception as an “Education/Advocacy” approach) while others may require a complex multi disciplined approach (i.e. “Fishery Interaction” requiring a balanced mix of legal, advocacy education, and research).

6. Rank the importance of actions that can be taken to address the issues:

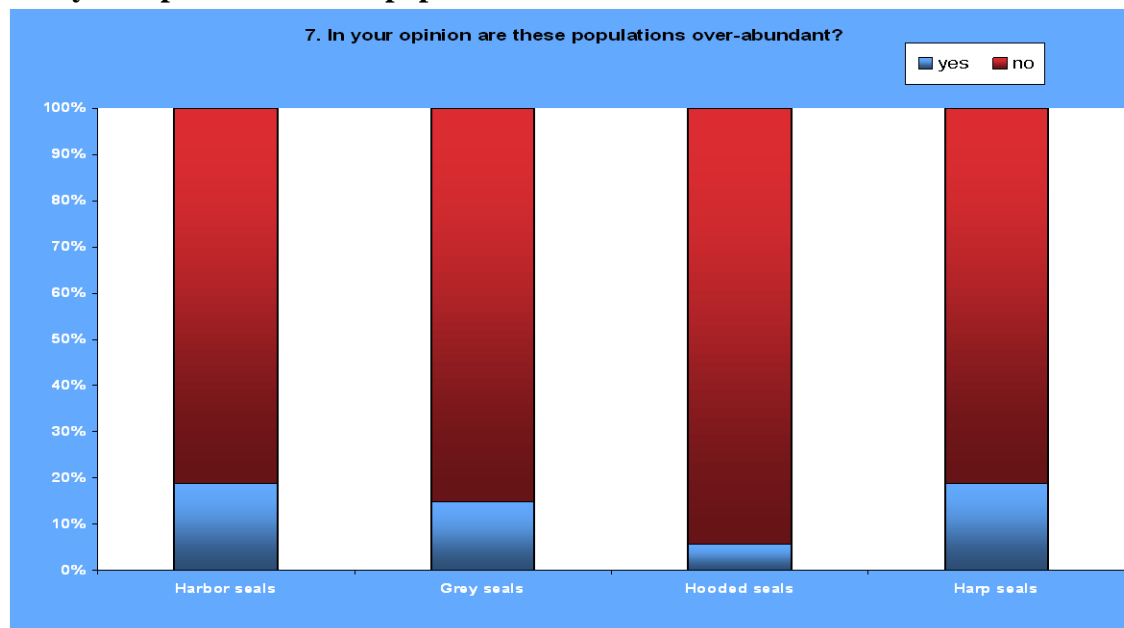


6. Rank the importance of actions that can be taken to address the issues.									
answered question		57							
skipped question		5							
	1 low	2 med-low	3 medium	4 med-high	5 high	0 N/A	Rating	N	stdev
Scientific Research	0.00%	0.00%	1.80%	15.80%	82.50%	0.00%	4.81	57	33%
Research/industry partnersh	1.80%	5.30%	14.00%	26.30%	52.60%	0.00%	4.23	57	20%
Professional networking	0.00%	1.80%	32.10%	32.10%	33.90%	0.00%	3.98	56	18%
Small focused meetings	1.80%	3.60%	32.10%	32.10%	30.40%	0.00%	3.86	56	16%
Advocacy	7.30%	5.50%	41.80%	20.00%	23.60%	1.80%	3.48	55	15%
Social Networking	9.10%	20.00%	29.10%	23.60%	14.50%	3.60%	3.15	55	9%
Large group meetings	7.10%	14.30%	48.20%	23.20%	7.10%	0.00%	3.09	56	17%

Results: The results ranged from “moderately high” importance to “moderately important” and appear to show clear preferences. “Scientific research” clearly has the highest ranking with the greatest “high” importance rating (80%). There seems to be a fairly clear pattern of declining “high” rankings for the rest of these. “Research/Industry partnerships,” “Professional networking” and “Small focused meetings” have the highest number of “high” and lowest number of “low” rankings.

Conclusion: There is an obvious preference of scientific research. There appears to be fairly strong preference for collaborator actions and activities. Coupled with the preference for “Shared data” this appears to indicate a strong preference for greater and more formal collaborations including greater inclusion of industry partners.

7. In your opinion are these populations over-abundant?



7. In your opinion are these populations over-abundant?

answered question 54
skipped question 8

	Yes	No	Response
Harbor seals	18.90%	81.10%	53
Grey seals	14.80%	85.20%	54
Hooded seals	5.70%	94.30%	53
Harp seals	18.90%	81.10%	53

Results: Roughly 20% of those polled considered harbor and harp seals, and 15% gray seals, overabundant.

Conclusion: This is a largely value-driven assessment and points to the importance of identifying means to better make this assessment using clear and addressable criteria.

Survey Results Summary

It appears that the group polled felt most strongly that scientific research is the overall most valuable tool and direction for future effort. There was, however, less clear indication of the general direction of that research – all research seems fairly important. This could be an impediment if it obscures a specific direction for research to address issues.

While some may be addressed purely as scientific questions, some may require complex interrelated and coordinated efforts. These seem to be grouped into “Research” issues (those approached by research alone), “Social” issues (those addressed by advocacy/education) or “Mixed” issues (those that should be addressed by a combination of strategies). Those issues identified by the survey as “Research issues” included: Lack of data on the distribution, status and abundance of seals, Role of seals in ecosystem functions, Habitat interactions, Interactions with protected species, Habitat and Aquaculture interactions. Issues identified as “Social Issues” included Perceptions of seals by humans, Social issues of balanced wildlife management and Response to stranded animals. Fishery Interactions was a “Mixed” issue indicating that the approach to this issue would include a coordinated combination of regulatory, social and research strategies. Funding is considered a major impediment. Some (around 20%) feel that seals are overabundant. This is a difficult issue to quantify and is “value-driven.” Better criteria are needed to clarify this issue and better direct future.

Collaboration through professional networking, sharing of data and formalizing research and organizational relationships appears to be an important key.

Post-Workshop Survey

Post-Workshop Survey					
1. Our pre- meeting survey showed a preference for short, focused meetings/workshops. Considering this, how would you rate the two-day format?	Too Short	Short	ok	Long	Too long
	0%	18%	73%	0%	9%
2. Our first day consisted entirely of short (15 minute) presentations. Would you prefer longer but fewer talks?	Yes	No			
	0%	100%			
3. What is your opinion of the overall group size of the meeting? of the working groups?	Too small	Just right	Too Large		
	0%	91%	9%		
	0%	82%	18%		
4. How would you rate the overall quality of the presentations:	low	med low	med	med-high	high
Population topics?	0%	0%	22%	56%	22%
Disease topics?	0%	0%	33%	33%	33%
Human interaction topics?	0%	30%	20%	40%	10%
5. Please Rate the Quality of the Following:	low	med low	med	med-high	high
Woods Hole location	0%	10%	10%	20%	60%
Accommodations	0%	0%	11%	22%	67%
Meeting/discussion room(s), Food/breaks	0%	10%	20%	30%	40%
6. How often would you like to see similar meetings/workshops?	6 mos	1 year	18 mos	2years	
	0%	33%	22%	44%	
7. How useful was this workshop -	Not useful	Fairly useful	Useful	Very useful	
for networking with other researchers/stakeholders?	0%	22%	22%	56%	
in identifying issues relating to seals in the gulf of Maine?	0%	44%	11%	44%	
in identifying strategies and tools for addressing these issues?	22%	22%	44%	11%	

The chart above is a summary of the results of an on-line survey conducted following the WHOI workshop. Instructions and the web address of the survey were sent to the same mailing list used for invitations to the workshop. There were eleven (11) responses to the survey.

These results indicate a general satisfaction with the workshop format, length and size of meeting and workshop groups. Respondents ranked the Woods Hole location and the facilities at WHOI highly.

Respondents favored meetings at intervals from one and two years.

Those that responded to the survey agreed that the meeting was most useful as a means of networking with other researchers and stakeholders. This agrees with the pre-workshop survey, and results of discussion groups that networking, and information sharing is recognized, as a primary and basic, common need for stakeholders with an interest in pinnipeds in the Gulf of Maine. A lack of ongoing discussion and contact with others appears, likewise, to be critically lacking. This workshop format appears be a good template for future meetings.

Presentation Abstracts

Harbor Seals in the Gulf of Maine

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Harbor seal populations have increased over the last 35 years. During this time, the ratio of pups to non-pups has increased as well, indicating a population that is likely not above the MNPL level. Other work from University of Maine includes fisheries interactions with aquaculture, and research on development and growth of nursing pups. Previously published and completed theses results are summarized.

U.S. Gray Seal (*Halichoerus grypus*) Recolonization: Status and Stock Structure

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Gray seals (*Halichoerus grypus*) were historically distributed along the Northeast coast of the United States (U.S.), through the 17th century. They were infrequently reported for much of the 20th century, but have recently established significant breeding colonies in the U.S. They have been observed using the historic pupping site on Muskeget Island in Massachusetts since 1988. Pupping has taken place on Seal and Green Islands in Maine since at least the mid 1990's. We present aerial survey data of these sites indicating that these local populations are increasing. Two large populations in Canada (Gulf of St. Lawrence and Sable Island) are both possible sources of immigrants for the recovering U.S. population; some of the early and current breeders in the U.S. have brands and tags indicating they were born on Sable Island. To assess the stock structure of gray seals in the Northwest Atlantic, a total of 262 tissue samples were collected from both Canadian and the U.S. populations for genetic analyses. The combined use of nine highly variable microsatellite loci and of the mitochondrial control region as molecular markers indicates that there is little population differentiation in gray seals in the Northwest Atlantic.

Harbor seal prey selection in the Gulf of Maine

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The study documents the summer diet of harbor seals (*Phoca vitulina*) in the central Gulf of Maine, in relation to the abundance of seal prey species and the age class of ingested fish. We found no relationship between harbor seal prey selection and the total abundance of seal prey species in the Mt. Desert Rock foraging area. Instead, our results suggest that foraging harbor seals select for particular age classes within the three primary prey species. Fourteen species or taxa were identified as summer harbor seal prey, ten taxa (nine finfish and one squid) comprised over 95% of the ingested biomass. Atlantic herring (*Clupea harengus*), silver hake (*Merluccius bilinearis*) and Acadian redfish (*Sebastes fasciatus*) were the primary species ingested. Most of the fish eaten by foraging harbor seals came from specific age classes. Seals selected for Age-1 (length range, 14 – 22 cm) and Age-2 (22-29 cm) silver hake, Age-0 (young-of-year; < 12 cm) and Age-1 (12 – 15 cm) Acadian redfish, and Age-4 (25 – 28 cm) Atlantic herring. Foraging seals shift consumption between the three primary prey species based on the relative abundance of the preferred age class(es) within each species.

The diet of gray seals (*Halichoerus grypus*) in United States waters, as inferred from analysis of hard parts and fatty acids

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Extinct in the U.S. prior to 1958, gray seals (*Halichoerus grypus*) now number more than 7,000 in New England waters, due in part to the success of the Marine Mammal Protection Act of 1972. The growing seal population in New England has raised questions about possible competitive interactions with commercial and recreational fisheries. I analyzed 305 seal scats, 49 seal stomachs, and 46 seal blubber cores in order to 1) determine gray seal diet composition, 2) investigate individual, regional and temporal variation in diet, and 3) identify potential seal/fishery conflicts. Of 29 prey taxa recovered, 9 were considered important, in that they comprised more than 5% of the diet by weight, number and/or frequency. Of these, sand lance (*Ammodytes spp.*) dominated the diet by weight (54% of total) and by number of prey individuals consumed (66% of total). Sand lance are not targeted commercially on a large scale in the U.S. Skates were recovered most frequently (26% of samples). Atlantic cod and Atlantic herring (*Clupea harengus*) comprised 6% and 4% of the diet by weight, respectively. Significant sex and regional differences were detected in both stomach contents and fatty acid profiles. Seal diet diversity was highest in spring, and the diet of seals <2 yrs old was more diverse than that of adults.

Overview of the Northeast Fisheries Science Center Seal Research Program

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New England populations of harbor seal (*Phoca vitulina*), and gray seal (*Halichoerus grypus*) have increased and expanded their range in the 35 years since passage of the U.S. Marine Mammal Protection Act, (1972). Since the early 1980s the Northeast Fisheries Science Center (NEFSC) has supported a variety of projects on seal ecology within this region. However, the majority of these projects have been both short duration (i.e., one to a couple of years) and low budget (< \$50K). Three longer term projects that have provided valuable information on seals are: 1) the Northeast Fisheries Observer Program and 2) southern Massachusetts aerial monitoring surveys, and 3) monitoring gray seal pup production at three New England colonies. Since 1990, observer data have been used for bycatch analyses and to model fishery characteristics (e.g., gear, mesh size, spatial/temporal patterns and effect of pingers) associated with bycatch. This program has also provided important biological samples for diet, and other life history studies. Since 2005, the NOAA Twin Otter has been used to conduct aerial surveys off the coast of southern Massachusetts roughly once per month from October to May to assess the abundance and distribution of harbor seals and gray seals in this region. These surveys have also documented annual and seasonal shifts in seal distribution due to alteration of beach and tidal sandbar topography by winter storms. A GIS data base has been developed for the aerial survey data (e.g., counts and associated covariates). Ultimately, this will allow researchers to evaluate spatial and abundance trends for both species at both individual haul-out sites throughout southeastern Massachusetts.

Harbor Seal (*Phoca vitulina*) and Gray seal (*Halichoerus grypus*) movements in New York and Gulf of Maine

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The increase in pinniped strandings in the northeast United States has been well documented. The initial increase was attributed to the higher numbers of harp seals (*Pagophilus groenlandicus*). Since its inception in 1996 the Riverhead Foundation for Marine Research and Preservation has been conducting seal counts in New York waters. During these counts harbor seals (*Phoca vitulina*) were the most commonly encountered pinnipeds, however in recent years there has been an increase in the number of gray seals (*Halichoerus grypus*) observed. This increase, from sporadic sightings of one or two gray seals (*H. grypus*) on or near harbor seal (*P. vitulina*) haul out sites (Great Gull and Little gull, NY), has risen to 41 animals in '07, 190 in '08, and 275 in '09. A similar trend was also observed in the number of animals recovered by the New York State Marine Mammal and Sea Turtle Rescue Program (NYSMMSTRP). Twenty nine animals recovered by the NYSMMSTRP were able to be tracked with satellite tags after their release. Post rehabilitation monitoring has been conducted on animals released in New York State since 2003. Over the last six years the Riverhead Foundation for Marine Research and Preservation satellite tagged 16 harbor seals and 13 gray seals. The mean tag duration for harbor seals was 118 days (range 30d, 455d) while gray seals had a mean tag duration of 85 days (range 14d, 267d). The post rehabilitation monitoring was conducted with two types of satellite tags provided by Wildlife Computers. The first tag was a position only tag (Spot-5) and the second tag provided positional data along with dive depth, duration and maximum dive depth (Splash). The initial reason for satellite tagging these animals was to assess rehabilitation success. Position only tags were used 62% (n=8) of the time for gray seals (*Halichoerus grypus*) and 44% (n=7) of the time for harbor seals (*Phoca vitulina*). The mean distance traveled was 1,850 km (range 270km, 5,781km) for gray seals (*H. grypus*) and 1,527 km (range 507km, 2,888km) for harbor seals (*P. vitulina*).

White shark predation and the implications of increasing pinniped populations

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There is empirical and anecdotal evidence that the number of shark-pinniped predation events has been rising in recent years off the coast of Massachusetts. In most cases, these interactions have occurred adjacent to Monomoy Island, which hosts a sizeable population of gray seals (*Halichoerus grypus*). The great white shark (*Carcharodon carcharias*) is a documented predator and scavenger of marine mammals and has been the species implicated in many of these interactions. In sharks, changes in predatory behavior have been associated with ontogeny, changes in prey abundance, changes in shark population density, and ease of prey capture. While the perceived increase in shark predation on gray seals can be attributed to several factors, it is feasible that white sharks, which generally feed offshore in the Atlantic, are exhibiting a dietary shift in response changes in seal abundance. Studies off the coasts of California (South Farallon Islands) and South Africa (Seal Island) have documented white shark predatory behavior on juvenile northern elephant seals (*Mirounga angustirostris*) and Cape fur seals (*Arctocephalus pusillus*), respectively, as it relates to several factors (e.g., prey availability, prey size, season, depth, tide). Based on these case studies, this presentation reviews white shark predatory behavior and explores the implications of increasing seal populations in the Gulf of Maine.

Otitis Externa & Otitis Media in Phocids

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Otitis media is an emerging infectious disease of phocids. The condition represents a serious disease in seals which may serve as biological indicators of environmental degradation and anthropomorphic bacterial contamination of coastal waters. The diagnosis, anatomy, treatment options, and sequela for seals with ear disease is discussed. The preferred diagnostic test is computed tomography, but requires scanner access and sedation or anesthesia. The significance of middle ear disease in seals is reviewed from the point of view of the medical case management of individual stranded or captive seals, along with the roles seals may play as a disease model for the most common childhood infection of people and as sentinels for environmental disturbance.

TBA- Viruses and Seals

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The ecology of Sable Island Grey Seal, *Halichoerus grypus*, population

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The grey seal, *Halichoerus grypus*, population on Sable Island has been growing since DFO began monitoring pup production in 1962. Until 1990, complete cohort marking was done with flipper tags. Now, aerial photography is used to achieve a reliable estimate of pup production every few years (1993, 1997, 2004 and 2007). Between 1962 and 1997 the Sable Island grey seal population increased exponentially at a rate of 12.8% (doubling time of a little less than 6 yrs). Sable Island is now the largest grey seal colony in the world. The estimated total pup production in 2007 was 54 500. There is evidence of reduced rate of population growth since 1997 suggesting density-dependent population regulation. DFO's Sable Island grey seal research program, developed in collaboration Dalhousie University, includes work on population dynamics, reproduction, and foraging ecology. We study long-term changes in reproductive performance and survival with sightings of permanently marked individuals. Between 1963-2002, 7 200 newly weaned grey seals were branded on Sable Island, and since 1983 we have completed weekly censuses during the breeding season to locate all uniquely branded individuals. These long-term data are needed to predict how the population will respond to environmental variability and human activities. Stable and radio-isotope dilution methods have been used to study the transfer of energy from mother to pup and also study seasonal changes in body composition of adults. These studies have revealed marked differences between males and females in seasonal changes in energy storage and expenditure. Further investigation into foraging ecology using quantitative fatty acid signature analysis (QFASA) to estimate the diet, shows strong sex differences and seasonal changes and interannual variability in the prey composition of both males and female diets. Data recorders and satellite, GPS and VHF telemetry have been used to investigate diving behaviour and the spatial and temporal distribution of wild seals. Breed et al. (2008) show sexual segregation of foraging varying with season, with males foraging on the shelf edge further from Sable Island than females. The continued growth of the grey seal population has raised concerns about the potential impact of Grey Seal predation on commercially important fish and invertebrate stocks in eastern Canada. Data on the grey seal abundance, distribution of foraging, diets and energy requirements have been integrated to estimate the impacts of grey seals on prey. Trzcinski et al. (2006) estimated that about one quarter of the natural mortality of cod results from seal predation in the NAFO area around Sable Island (4VsW). Recently, we have been working with National Geographic's Crittercam to study grey seal predation events to ground truth our QFASA estimated diets and our interpretations of the diving and movement behaviour. We are also planning to study predator-prey interactions by attaching VEMCO business card tags and GPS/Argos tags to adult seals. The business card tags will receive signals from acoustic tags surgically implanted in potential prey such as cod, pollock and flatfishes. These data will allow us to test the hypothesis that seal predation is contributing to increased natural mortality in larger cod and other species.

An Overview of Emerging Infectious Diseases in Marine Mammals with Emphasis on the Lessons Learned from the 2006 Distemper Outbreak in the Gulf of Maine Seals

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Infectious diseases are capable of exerting considerable negative control on wildlife populations, not only in terms of causing mortality/epizootics, but also with regards to effects on body condition and subsequent ability of infected

animals to reproduce. Infectious diseases are one of the leading causes of so called “Unusual Marine Mammal Mortality Events” occurring in American waters and epizootics of marine mammals have been reported and studied from around the world. In addition to causing die offs of marine mammals, some infectious diseases can be transmitted to, and cause serious diseases in humans. This is an important consideration where marine mammals are hunted and used for food (arctic Canada) but is also a concern where there is human interaction with stranded animals (rehabilitation). The problem of marine mammal zoonoses (diseases transmitted from animals to humans) is well recognised in both Canada and the US and government programs to track, diagnose and treat diseases of importance are being developed in conjunction with human health and animal health agencies in both countries.

Since 1987, a number of marine mammal epizootics caused by different distemper viruses have occurred and distemper is considered by many as the greatest single threat to marine mammals. Phocine distemper virus (PDV) has been responsible for epizootics of harbor seals (*Phocavitulina*) in Northern Europe in 1988 and again in 2002 with mortalities of about 20,000 in each event. No epizootics attributed to PDV have so far occurred in North American seals. Historically, there is indirect serological evidence of distemper being present in North American seal populations and a few sporadic cases of distemper have also been reported. Though the distemper outbreak in the Gulf of Maine seals in 2006 posed some interesting challenges in the short term, it has greatly increased our understanding of this disease in North American seals including its diagnosis, pathology and threat to animals both in rehabilitation and in the wild. This is in large part due to advances in the development of new techniques for the isolation of distemper viruses, molecular genetic techniques such as polymerase chain reaction (PCR) and serological methodologies which will contribute to a better risk assessment of this particular disease threat over time, as well as providing a model for use in other disease outbreaks – when they occur.

Marine mammal disease management (or NOT)

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Wildlife management is the “science and art of changing the characteristics and interactions of habitats, wild animal populations and humans in order to achieve specific goals”. Esthetic, economic, or ecological goals may be involved. Classically management of wildlife populations has been directed mostly to terrestrial big game, waterfowl and fish primarily for human consumptive use and populations were managed to ensure a “sustainable yield”. Marine mammals were heavily exploited in the past, mostly for their oil and furs with little “scientific” management of stocks, leading to near extinction for some species. Fortunately, protection was eventually afforded in many jurisdictions for threatened species and population recoveries have been spectacular in some cases. Unfortunately, population recovery has been slow in other over-exploited marine mammal populations who now face new threats including from diseases and human activities. Disease, while recognized in some wildlife populations, was not given much consideration by wildlife managers and biologists until relatively recently. The ecology of disease in wildlife populations including marine mammals especially in light of habitat degradation, climate change and particularly for species at risk is an active area of research and interest. Large growing populations of some marine mammals such as some phocids or otariids may be at risk of catastrophic epizootics particularly if the number of susceptible individuals increases, new exotic diseases are encountered or some environmental factor causes an immune or physiological imbalance. Large populations may be reservoirs for certain diseases permitting their continual circulation and putting less numerous and susceptible species at risk. Human activities may also affect disease prevalence, severity and transmission. Natural disease outbreaks are usually self-limiting and may serve to eliminate unfit individuals – interventions if undertaken generally arrive too late and serve little purpose - monitoring such events and documenting causation adds to our understanding of ecological processes. Alternatively, acute massive mortalities or chronic small-scale mortalities associated with human-perturbed ecosystems should serve as warnings that we need to manage better human behaviour and human activities.

Pathology of NE Pinnipeds-Greatest Hits

From One Hit Wonders to Perennial Favorites

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Determination of cause of morbidity and mortality are important for animal populations not only for the animals in question, but also for other species that may share a similar habitat or food supply as well as serving as an indicator or sentinel species or as a model for endangered populations. Conditions that are observed can be limited to an individual animal, represent a population-wide disease that may be endemic (enzootic) or an epidemic (epizootic). In the determination of conditions observed, the following short-list can be observed: degenerative, anomalies, metabolic, neoplasia, infectious, inflammatory, toxic, and trauma (D.A.M.N.I.T.). The same can be said of observations in pinnipeds from the Northeast. Diseases observed include infectious (*Nocardia*, morbillivirus, fungal/algal dermatitis, protozoal encephalitis, herpesvirus), neoplasia (lymphosarcoma), adrenal gland dysfunction, entanglements and other human interactions, vertebral anomalies and fractures. The leap from an “interesting finding” to an index case that signals the beginning of an epizootic or that is an indicator of an endemic disease or condition cannot be predicted with a few cases, but with enhanced surveillance, the impact upon the population may be determined over time.

The cultural nature of seal-fisheries conflicts

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There is a widely held view that conflicts between seals and fisheries – whether real or perceived – could be resolved if only we had more scientific information at our disposal. I argue, however, that science alone will not resolve conflicts between seals and humans – in particular, conflicts between seals and fisheries. Typically, such conflicts are treated either as controversies arising from scientific uncertainty, or as controversies involving scientific facts on the one hand, and unscientific emotions on the other. The fact is, however, that such controversies actually stem from conflicting values that exist within a society, and from the different objectives that individuals and groups of individuals are pursuing at the time.

While such a view may seem unconventional to some, I also argue that values play a central role in all aspects of fisheries and wildlife management, and conservation. The decision “to conserve” depends not on science or scientific evidence, but rather on societal values and objectives. Decisions to maintain biodiversity, to remove a particular yield from a wild population, to declare a species endangered, to “control” or cull a population, or to exterminate a “pest”, are also driven by values, not by science.

Whether scientist, manager, or conservation activist, those who advocate for a particular management or conservation action are promoting a set of values. Public opinion, one target of such advocacy, is also based on values. When values are in dispute, as they frequently are in the fields of fisheries and wildlife management, and conservation, society chooses among the competing values – at least in the democratic world – through a process called politics. Politicians – variously known as “policy-makers” or “law-makers” – are reactive by nature and usually implement public policy that reflects the values of those who “win” the political debate. Similarly, legislation, more often than not, reflects the values of those who “win” the political debate.

The take-home message is that values – the values of the politically relevant – and not science, are at the center of all discussions and disputes in fisheries and wildlife management, and in conservation. The time has come for managers and policy makers, to acknowledge formally people’s various perspectives, and not just science, in order to find solutions to controversial problems. As others have noted, “Science is mute on the values that underlie the decisions societies make” and it rarely provides “the answers to the policy makers’ ultimate questions”. While the mainstream may still claim that science “anchors” decisions in fisheries and wildlife management, and conservation, subjective value judgments and political expediency actually determine which policy is ultimately implemented.

What are seals doing in the Gulf of Maine?

G. Early

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This talk was originally presented at the Maine Fisherman’s Forum 2009 in Rockland Maine. It is a broad overview of the issue of pinniped interaction with commercial fisheries in the Gulf of Maine and the complexities of this relationship. I propose that biologists and fishers share a problem of limited data inhibiting a better understanding of this relationship. I suggest two ways in which fishers can contribute to solving this problem by supporting biological studies of pinnipeds in the Gulf of Maine and by supporting and assisting fisheries observers. These tools are essential for a better understanding of the ecological interactions of pinnipeds and fisheries in the Gulf of Maine.

Interactions Between Harbor Seals and Atlantic Salmon Aquaculture In Maine

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The emergence of Atlantic salmon (*Salmo salar*) aquaculture as the second most valuable “fishery” within the State of Maine has coincided with substantial increases in regional populations of harbor seals (*Phoca vitulina concolor*). High densities of fish concentrated in relatively small areas, such as net-pens, inevitably appeal to fish-eating wildlife. This study details the nature and frequency of seal predation at Atlantic salmon farms in Maine. Farm managers were surveyed annually, from 2001-2003, to document management techniques, husbandry practices and predator deterrence methods employed for comparison with the extent of seal predation. Bi-weekly aerial surveys were conducted between January and March of each year to catalog winter harbor seal presence and determine whether the severity of predation was related to the proximity of farms from one another and nearby haul-outs. The results of this study suggest seal predation may be reduced by maximizing the distance between farms and seal haul-outs. The

regular replacement of primary and secondary cage netting was found to be negatively correlated with seal predation. Finally, this study documents the apparent ineffectiveness of acoustic harassment devices at deterring seal predation.

Seals, models, and ecosystem-based fishery management: the big picture

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Implementing ecosystem-based fishery management (EBFM) is perceived as one of the solutions to our current problems in marine environmental management. The principle behind EBFM is supposedly to ensure that maintaining healthy ecosystem function takes priority over maximizing fisheries yields. However, some national implementations of EBFM include culling seals as a primary component. Sport hunts for gray and harbor seals off the Norwegian coast, and the Norwegian hunt for harp seals demonstrate this. Yet the models available – for gray and harp seals off Canada, and harp seals in the Barents Sea – provide no evidence to support the contention that culling seals (or other marine mammals) will enhance fisheries yields. Likewise, the two massive collapses of harbor seal numbers in European coastal waters over the past few decades were not accompanied by detectable improvements in fisheries. Currently, the best science available provides no justification for culling marine mammals in the hopes of enhanced fisheries yields. EBFM-as-culling is the perfect antithesis of EBFM as described in the professional literature, yet attempts to draw attention to these conflicting interpretations of EBFM have been derided by senior members of the fisheries science establishment. This is just one of the reasons why EBFM has recently been described as “meaning everything and nothing” and “has devolved toward vacuity”. Those seeking to apply EBFM need to make explicit what they see as the place of marine mammals in their conception of EBFM and how it differs from those who would use the concept as just another excuse to cull predators.

Perspectives on seal interactions with Cape Cod commercial fisheries: Localized depredation or large-scale competition?

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As local seal abundance increases, so does reporting of fishing gear depredation by seals and concern about the larger-scale ecological interaction (competition) between seals and commercial fisheries. The perception of fishermen that significant ecological interaction occurs comes largely from observations of depredation, during which seals directly remove target species from fishing gear. Depredation by seals was observed or reported in most Cape Cod fixed-gear fisheries. However, it is difficult to quantify the extent of these interactions and to determine if they represent significant competition on a scale greater than that of the area or gear fished. In collaboration with the commercial fishing industry, we are studying seal depredation in fixed fishing gear, seal diet, and individual residence and

movement patterns in order to better understand the ecological role of seals in Cape Cod waters. Here we present estimates of seal depredation in the Nantucket Sound weir fishery and a comparison with diet studies in the same area. Differences were observed in the species composition of seal prey represented by hard parts in scat and stomach contents, observed during depredation in fish weirs, and reported in other fisheries. These observations are placed in a broader ecological context incorporating hypotheses regarding foraging behavior and movement. Participation of the fishing industry in collaborative research provides a means to fill critical data gaps and research needs.

Pinniped Entanglement and Disentanglement on Cape Cod, Massachusetts

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The International Fund for Animal Welfare's (IFAW) Marine Mammal Rescue & Research Program (formerly the Cape Cod Stranding Network) has been responding to live and dead pinniped strandings on Cape Cod and southeastern Massachusetts since 1998. During these responses, IFAW MMRR is required by NOAA Fisheries to examine every animal, whether alive or dead, for signs of Human Interaction (HI) and document any potential evidence. If present, evidence is evaluated to determine if the HI contributed to the stranding event. Since 1998, the predominant types of HI that IFAW MMRR has documented include entanglement, vessel interaction, gunshot, debris ingestion, and harassment by humans/pets. Human Interaction cases have occurred throughout IFAW MMRR's response area and are observed in all months of the year. For those cases in which an HI determination could be made, 20% of the stranded pinnipeds showed signs of human interaction. Entanglement in fishing gear and marine debris represents 49% of all HI cases. In an effort to mitigate the growing problem of live seals entangled in fishing gear and marine debris, IFAW MMRR implemented a Disentanglement Program in 2003 to capture hauled out entangled seals and remove any gear present. A key part of this program was the use of directed surveys of the seal haul outs to document the rate of entanglement. Data revealed that entangled animals were present in almost every haul out. As a result, systematic disentanglement efforts were undertaken seasonally to ensure proper staffing and tidal conditions for each trip. The program has been marginally successful, challenged mainly by the extreme difficulty in successfully approaching and capturing hauled out seals. While we hope this focused approach will lead to more successful disentanglements, the greater problem of preventing entanglements before they occur still remains the essential goal.

Pinniped Stranding Response and Rehabilitation in the NER-More questions than answers

M. Garron

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This talk was originally presented at the Maine Fisherman's Forum 2009 in Rockland Maine. It is a broad overview of the issue of pinniped interaction with commercial fisheries in the Gulf of Maine and the complexities of this relationship. I propose that biologists and fishers share a problem of limited data inhibiting a better understanding of this relationship. I suggest two ways in which fishers can contribute to solving this problem by supporting biological studies of pinnipeds in the Gulf of Maine and by supporting and assisting fisheries observers. These tools are essential for a better understanding of the ecological interactions of pinnipeds and fisheries in the Gulf of Maine.

The Northeast Fisheries Observer Program Overview of Data Collection and Biological Sampling

Amy Sierra Van Atten

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Under the Marine Mammal Protection Act (MMPA), NOAA Fisheries Service (NMFS) has the authority to place observers on board vessels engaged in commercial fishing operations that incidentally take marine mammals. Data collected by NMFS observer programs are used to assess the level of serious injury and mortality of marine mammals, develop marine mammal stock assessments, and identify bycatch reduction measures to ensure the recovery and conservation of these species. The Northeast Fisheries Observer Program (NEFOP) deploys observers on multiple Category I (MMPA) fisheries in the Northeast U.S. and regularly documents incidental takes. The NEFOP will summarize the number of seals observed in recent years and what has been done with the data and samples collected. The NEFOP would like to continue to collaborate with pinniped researchers and scientists in order to identify priorities and enhance communication on sample transfers and other educational outreach to observers and fishermen.

Seals: Beauty and the Beast

Sharon B.Young

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Harbor seals and other pinnipeds in New England were once reduced to remnant populations thanks in part to bounties placed on their noses as recently as the 1960's. Since 1972 their populations have rebounded under the U.S. Marine Mammal Protection Act. While the sights and sounds of seals once again sunning themselves on rocks and giving birth to their pups along our coast brings tourists to our shores and thrills many; others are less than thrilled. Fishermen have expressed concern that there are "too many," and in Canada they are killed by the thousands. Whether seals are a beauty or a beast depends on perspective. This talk will explore the basis of our reactions to seals and increasing seal populations and will explore various management measures that are, have been or could be employed in situations of perceived conflict.

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Edited transcripts from working groups and general meeting discussion

Population Dynamics Working Group

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13	Gordon	Waring
14	Fred	Wenzel
15	Stephanie	Wood
16	Colby	Moore*

Goals:

1. How to build a community of people interested in populations
2. Identify issues around populations
3. Develop strategies for solving issues

Issues:

A. Stock Structure:

1. Harbor Seals- We know from research in other regions there are likely to be sub-structures of populations of harbor seals. Without knowing this we can't determine the impacts on these sub- populations. The most effective time to do this is during the pupping season.

2. Gray Seals – S. Wood's work has established that they gray seals are only one population but issue remains for harbor seals. So far no one has come up with money to do it for harbor seals.

- Question: How much money required?
- \$10,000-\$15,000

- Possibly some samples already available.
- Question: What is the best way to approach answering this question?
- We may be able to utilize existing samples. Some tissue samples available from Jericho Bay. Getting more samples likely wouldn't be that expensive

B. Population Numbers:

1. Harbor seals
2. Gray seals

- We have an unknown stock status for harbor seals
- Gray seals – we've done single day counts but part of the problem is getting enough surveys in a year to establish an index
- Are we covering all the sites where pupping has occurred and where the seals are? Probably not. We likely need to cover additional sites. Some questioned whether there are large groups of pups in new areas. Currently surveys are limited to nothing north of Plymouth or south of Cuttyhunk, if there are any gray seals south of two islands in Maine, we are doing nothing.
- Recommendation: We should try to coordinate survey efforts between regions
- Recommendation: In Canada collaboration with fishermen was an effective tool for identifying new pupping sites.
- J.G. first heard about pupping on Seal Island from fishermen. Rumors of 50 white coat gray seals on Mt. Desert Rock this winter.
- For grays No Man's Island surveyed but no pups have been seen there. West of No Man's Island does not seem to be enough suitable habitat to support pupping.
- Possibly we could coordinate surveys with DFO
- Cobscook Bay and other areas are definitely affected by both US and Canadian activities
- Aerial surveys that are done:
 - Are the Twin Otter flight data mined? Yes, S. Wood's work was based on those.
 - All gray seal mom and pups counted through 2008 for Muskeget seal and Green Island.
 - However, beyond gray seal counts data sets from 2005 exist, but less than 1% has been analyzed.
 - Extrapolating to population size from single day aerial surveys is difficult (do you multiply by 5 or 6?)
 - For NOAA the goal of the flight data is to get an index of harbor and gray seals and track patterns of movement of seals over time. Currently, work is being done to establish a GIS database to incorporate this data that will help predict movement of seals.
 - One issue with aerial surveys is that we don't have accurate correction factors to extrapolate to population size based on the number of animals out of the water.
 - There's a need for surveys during all seasons, including at times other than pupping seasons. Such censuses are necessary for determining ecological impacts of events such as oil spills or drilling
 - To establishing accurate correction factors we need to know fraction of time out of water. Satellite data might be helpful in determining this.

- We need to do a spring count- doesn't take long 4.5-5 days to count the Maine coast in wintertime and not very many sites.

C. Anthropogenic Issues

1. Effects of noise

Comment: We don't understand how much they use sound in water and on shore. We also don't know how much sound is out there from sources such as vessels and wind farms. We need to know what noise is out there (via acoustic monitoring) and also need to know what they can hear. Audiograms of harbor seals are out there but there is limited info on other species. For the species we do have data for the sample size is low and most done on adults.

D. Are there harbor seal pupping sites south of Maine?

- Reports of harbor seals at Manomet (mid to end of May), Provincetown, and Connecticut (Mid to end of May).
- Reports of fetuses in Plum Island
- Most of these have lanugo suggesting early births
- There have been pregnant females in NY as well
- As we plan harbor seal surveys during the pupping season we need to include points further south? Are these isolated incidents? Does it warrant extensive research?
- Is pupping occurring on Cape Ann?
- There doesn't seem to be much boat coverage there in spring during pupping season.
- Right now we are operating on the assumption that pupping doesn't occur outside of the regions that we survey but we aren't looking and aren't looking systematically.
- Cape Ann boats now in May/June? No too early for whale watches to be out, nobody out there normally. There are a lot of areas not covered and there are no people out there - so no reports.
- We are not looking, so it's not that it's not happening.

F. Is population productivity increasing?

- The earlier harbor seal surveys were done after peak pupping and may have been done after dispersal.
- More recent harbor seal surveys show pup productivity increase, 33% is too high in a population model. This percent seems to be unrealistically so we may be missing some part of the population.
- Sable Island harbor seal population is gone. Coordinating with Canada is a good thing.

G. Question regarding climate change effect on range with global warming

- Increased storm intensity may affect habitat. Sea surface increase, more beach erosion, displacement, but maybe there will be more sandbars near Nantucket.
- Tidal range will affect area available from pupping (one of every 4 seals out there is a pup).
- Midden piles seem to suggest warmer waters in the past

- In Canada variability in ice hasn't reduced population. Instead, seals have moved to islands.
- Predators – if seasonality changes then you get greater overlap between seals and their predators. (White sharks do get into the GOM but not much evidence feeding on seals.)
- Climate may affect prey distributions -may be moving in response to prey items moving.
- Trawl surveys demonstrate fish are seasonal north to south and movements of seals correlates.
- New head of NOAA has asked NOAA offices to generate a list of potential species that may be affected by global warming. Seals were listed. Ice seals are especially vulnerable due to dependence on ice
- Habitat suitability models could be used to predict how different factors could affect populations
- Could there be a climate component to the increased harp seals range? Last time population was this big they weren't here.
- Why are some seals staying in ME and some moving south?

H. Fish/Food Habits –

- Some of best data comes from by-caught seals but these samples are biased
- Fatty Acid Techniques:
- How does a blubber sample work for pup? Does it transfer from mother to pup? Possibly but needs to be done.
 - Possibility to get blubber samples on harbor seals opportunistically when satellite tags placed on animals.
 - Problem with fatty acid techniques the expense associated with this is developing a library of prey items fatty acid signatures. Expensive, problems with sample storage?
 - Lots of incidental samples available
 - Do fatty acid signatures degrade over time?
 - Coordinated study plans: Fatty acid (gives 3-4 month prey info) and scat analysis (to give size data-covers limited time period and limited foraging area but gives size)
 - Lots of people beginning to do fatty acid signatures so there may be databases we may be able to tap into
 - Possibility of shared database??

Satellite tags:

- Currently used to say where they are going and dive behavior but also can be used for Surface use – also temp data can get at this
- Biggest problem with adults is getting the animals - we should try to get as much each animal as possible

I. Populations Dynamics/Marking Techniques

- More info needed to go from pup production to population estimate. Brand seal pups; the data set would be invaluable.

- Sample size from rehabbed animals big enough? Do people trust this as a representative population?

Tagging/Branding:

- We want to brand seal pups - we need some way to ID individuals and follow them
- Do flipper tags stay on? Even if you do, they are hard to see.
- Tagging – is a short-term tool vs. branding is a permanent tool. It gives you long-term life history data.
- Mortality tag would give a better tool from testing longevity
- What is age of first reproduction? How do we get to know this?
- Shooting animals as way to get this info too. Teeth can provide age data and you can determine pregnancy rates.
- Is there a way to get this data without killing the animal? Pull a tooth?
- Would branding work as well in a ledge habitat compared with sandy beaches?
- Two issues: 1) Survival 2) Re-sight
- Branding re-sight is easier with gray seals than harbor seals.
- Collecting pups easier in grays too
- Would it be possible to get a permit to brand animals?
- Any branded animals from Sable down here? (Yes).
- Fishery service just initiated a new animal care protocol.
- All research done, funded, or involving NOAA needs to go through this NMFS review process (IUCAC).

J. Fisheries Interactions

1. Direct:

- Animals are cut out of gear
- Aquaculture

Entanglements:

- More gray seals neck wraps – why? Foraging differences? Size differences?
- We are finding dead entangled juvenile grays on beaches. Smaller animals can't disentangle themselves; larger grays can but get neck entanglements. Rarely see a harbor seal with neck wrap.
- W. Coast – mostly sea lions that have neck wraps
- Problem with short nose sturgeon in Penobscot River – a couple gray seals specializing on them
- Gill net – small cetaceans and seal interactions – spatial and seasonally variable
- Not much pressure to do anything about seal bycatch and fisheries
- Issue of seals and fisheries from the point of view of fishermen, seals are a bigger problem than small cetaceans.

2. Competition:

- Gray seals – competition with fisheries – tag data may suggest that they are not foraging close to shore or is this a perception issues?

- Where are boats fishing off the Cape? *Nantucket Shoals, NW corner Georges, small boats not making week trips.*
- Correcting biases of bycatch – bycatch are not just random animals that run into fishing gear, they carry higher diseases, look more like stranded animals than “normal” animals.
- What fishermen tell us vs bycatch data are very different -
 - o Cod fish – size truncation due to seals, seals are removing a size class, but that specific size class is not showing up in any stomach content data. Ecological point of fishermen- you can predict where fish are going to be and now with the influx of seals, the spawning groups of cod are decimated. BUT there is no “hard evidence” about this.
 - How to get data??
- Is this a science problem? Or not? Need more information for fisheries interactions. Even explaining it “makes my head hurt”. If you have information that seals are NOT eating a size class, fishermen are not going to buy that, they see the seals out there and is it possible to change the perception of the fishermen.
- *We actually have very little information on what seals are eating.* 8 years after most recent study there was another, diet in Gulf of Maine is a small data pool. Fishing interaction talk yesterday looked like it happens in lots of places
- Fishing data may be biased data
- We are asking what seals eat? But ask, “What seals DON’T eat”. We think they don’t eat lobster, but all fishermen think they do. “My impression is that they eat most anything”. Individual learning going on also (sturgeon is the example).
- How do you get around these biases? Are bycaught seals sampling a representative sample that’s out there
- Fisherman reports, by-catch data, and scat data – at odds
- Ecological point fisherman brought up – fisherman fish specific season – seals are taking advantage of the seasonal movements of spawning fish – may be breaking up these schools
- Is this a science problem? Is this a perception problem?
- Fisheries problem seems like you need to approach it from multiple perspectives
- But definitely need more info
- Questions about whether science alone can change perception
- We spend a lot of time talking about interactions but we don’t have a lot of data about what these animals are eating
- How do we use this small pool of data to address this issue?
- More data needed
- If they have a choice of prey items, what do they feed on? What is the role of individual learning?
- Is it an issue with the large fisheries or with the individual fishermen? How do you reach them?
- Sometimes the answer is affirmative – they are having an impact but it’s hard to evaluate
- Recreational fishermen may be a place to start – approach from education and advocacy – precedent for buy-on

- There are other species out there eating the fish – seals are esp. visible and so they take more of blame.
- We may come to the point where we find that there is direct competition – where do we go from there ?
- Florida recreational fishing: sport fishing and dolphin depredation. Approach was education and advocacy. Very localized areas. Example of direct competition that's being worked on. Successful model??
- Other species out there eating fish, Pp scars on salmon. Other species are doing damage but Hg eats it right in front of you, that's annoying.
- Can we say they are OVER abundant because they interact with us? Is there a right that they have to the fish as we do? Maybe we just assume they are competitors and stop asking.
- Solutions to overabundance
 - o EXTREMES: culling or learn more for management measures.
 - o Seals are “running a 20 billion year sustainable fishery”.
 - o Educated approach or elimination – extremes.
- What's our end gauge here? *Baby steps so far in management.*
- Where do we go with the information about how much they're eating? What do we do with this info?

K. Seal parasites

- Marketing issue/handling time increases
- Codworm- Expansion in Canada
- Is it an issue in the U.S. too?

L. Disease/biotoxins

- Are seal populations controlled by disease or biotoxins rather than carrying capacity?
- Distemper in Europe is devastating – odd that distemper in U.S. circulates – possible because population circulates and exposes each other. This may be one advantage of abundant population
- Diseases from terrestrial animals could be an issue. Coyote interactions may be increasing on the Cape.
- Do stranding networks take blood samples and look for disease? *Yes as feasible.* Blood samples take but if the disease is looked for that's debatable. Samples are there, but is there anything done with them?
- Do we understand why the disease operates differently on the two sides of the Atlantic?
- Monitoring - most rehab centers have years of banked samples. Adults should be tested.
- Blood from adults captured should be tested for disease. Capture is next spring, permit in place.
- Harp and Hooded wild-caught animals tested for morbillivirus and herpes – some tested positive for morbillivirus

Contaminants:

- Regular monitoring program for contaminants in GOM needed
- How does contaminant load affect susceptibility for disease?
- Samples should be taken and analyzing

- How do we fund all this?
- When we are talking about contaminant loads we are not talking about local loads – we are talking about a broader geographic areas –they are sentinels but they are sentinels of a fairly large geographic area
- Possibly this may be contaminant specific – some may give a more localized picture in space and time

M. Data sharing

- J. Gilbert offering to put all the flight survey data out on the table.
- But how do we ensure correct interpretations? How do we agree to share it?
- If there was a way to formalize the sharing? People don't want publications stolen
- Possibly we could follow the OBIS model need to be clear whether you have right to publish shared data and in terms of giving credit once data is out there any one has access to it.
- Mystic has a comprehensive agreement that could be a model
 - Work currently being conducted for necropsy data base – helps to ID unusual findings
 - Databases exist for public orgs like NOAA – the public does owns that data
 - Gulf of Maine Ocean Data Partnership in place already could be tapped - J. Gilbert's data is there and is with OBIS sea map
 - Organization headed up by GoMOOS – let people know what data they have – provide meta-data
 - Possibly at the least people could post what types of data they have and the sharing status (completely shared, partially shared, private). This would allow us an overview of what research is being done at the very least
 - How do we encourage/facilitate communication?
 - Can share not just data sets but also expertise – can help with collaborative efforts
 - Inventory of “stuff” might be helpful but also might be hard to motivate people to post what they have
 - Whale Net - could this be used as a model?
 - One problem with some of these databases is their “usability”
 - Research Gate – Does it have a forum for seeking or offering assistance and expertise?
 - Pacific Consortium as a model? Right Whale Consortium?
 - Pacific Consortium more funding based – mostly privately funded by industry also funded by NMFS
 - Research Gate may provide a good resource
 - Agreement that we want to communicate via one of these venues but don't want it to bear the name “GOM”
 - Question how do we make it happen? Where do we go from here?

N. Meeting

- Should we plan small group meetings? How often should we meet?
- Fairly frequent meetings may help with networking and may be more effective than virtual meetings

- Meeting possibly every two years – possible to either focus on a new topic or to divide into groups – could do on the off-year of the Marine Mammal meetings
- Funding can be an impediment to these meetings. How do we address this?
- Possibly could be a one day meeting
- Possibly you could piggy back it on the back of another meeting - Stranding Meeting – may be too far away
- Virtual meetings? Possibly video conferencing
- Geographic areas we want to include? Probably not south of New Jersey
- Who will spearhead the next meeting? Needs to be at a facility that can handle the size.
- Possibly fewer talks and more posters
- Woods Hole seems to be a fairly central location

Current Planned Research:

Population Abundance Research Completed/Ongoing

Year	Species	Location	Season	<i>Piggybacking New Research?</i>
2009	Pv	NY, CC	Winter	
2009	Hg	CC	Pupping	
2010	Pv	Entire ME coast aerial	Pupping; late May early June	
2010	Pv	Tagging ME	March	<i>Diet study?</i>

Working Group Priorities (in order of descending importance)

- a. Abundance
- b. Long term studies on individuals: branding, ecological parameters
- c. Food habits and distribution – location of foraging –seasonal movements
- d. Fisheries interactions
- e. Stock structure

Future steps:

- 1) Find out who is interested in tackling these issues
- 2) Come up with budget
- 3) Find funding

Human Interaction Working Group

Working Group Participants and Chair (*rapporteurs)

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3	Jackie	Bort*
4	Peter	Corkeron
5	Ernie	Eldredge
6	Mendy	Garron
7	Charles	Harry
8	David	Lavigne
9	Betty	Lentell
10	Glenn	Mitchell
11	Aran	Mooney
12	Marcy	Nelson
13	Ben	Neville
14	Kristen	Patchett
15	Melissa	Sanderson
16	Lisa	Sette
17	Lauren	Wahl
18	Beth	Wetterhahn*
19	Sharon	Young
20	Kathy	Zagzebski

- Group Introduction

- **Identification of potential discussion topics:**

- Fisheries interactions

- entanglements
- depredation
- bycatch
- redirection of schooling fish, migratory routes

- Vessel interactions

- Beach interactions (education) → need to keep in mind the attitudes toward seals (currently not the attitude of wanting to shoot a seal on the beach, as is attitude in other places, although there is still attitude of not wanting the seals around)

- Need to keep in mind the changing world: climate change and its effects (habitat loss) → affects planning for the future (may also affect the future of species that are now considered “overabundant”)

- Ecotourism → need to develop guidelines for companies

- Acoustic interactions: chronic noise exposure

- Ecological interactions: pollution, climate change (habitat loss), marine debris
- Tools: outreach and education, research

Question:

- How are we going to continue interacting with these animals as their population numbers continue to increase? There's 'more than there used to be,' and that needs to be kept in mind.

Answers:

- If seal populations had remained constant, the number of interactions would still have continued to increase because of the increased number of humans in coastal regions.
- There are fewer species than there used to be historically.
- Fish and seal stocks have been undergoing co evolution for millions of years; humans are the third factor and have impacted that balance.
- The last 100 years have shown that we cannot manage populations → so now how do we manage our lives to minimize the deleterious effects on wild populations?
- There is constant redistribution of ~5,000 seals in the Cape Cod area → are redistributing haul out sites seasonally
→ need to start dialogue with the public to educate about the population and their movements (not a matter of overabundance, an issue of movement throughout the year)
- Individuals in some areas/regions perceive seals as being overabundant
- The situation is that there is a reintroduction of a large mammal into an industrial area that the species had been driven out of
- Group of bottlenose dolphins in a New Jersey river that was using a local prey source → public outcry to save animals; scientific consensus is that they are returning to an area they used to historically reside in
- Ecotourism can be a great tool for educating but has gray areas in regards to disturbing haul out sites
- There are more seals in the Gulf of Maine now than there were at the last meeting (in last 15 years)
- There is an increase in the number of interactions: due to an increased number of seals and/or humans?
- Need to move beyond baseline, need to consider what has changed in the last 200-300 years
- There is a ~300 year gap of information about population data: what was the historical population?
- Could use genetic tools or look back through records to gain a better picture of what historical population numbers were.
- Would be necessary in order to move forward, to understand the current state (overabundant?)

- Need to focus on the here and now, on what we can deal with now and what may be addressed in the future (as opposed to dwelling on the past so much)
- What are the positive and negative interactions between humans and seals (need to figure out how to effectively minimize the negative and maximize the positive)
- Need to discuss entanglement issues (need better understanding of gear types versus marine debris involved)
- There is a difference between fisheries knowledge and handling of entanglement issues by stranding programs (observer data is confidential → access to data may be important for understanding entanglement)

List of Specific Topics to Address:

Fisheries

- Depredation by seals → from gear
- Entanglement of seals in gear
- Bycatch of seals
- Diet studies: competition between seals and people for a limited resource) → suggested to be dropped from discussion (too big an issue to be tackled today)
- Ocean noise → suggested to be dropped from discussion (not enough time/information to discuss today)

Marine debris/entanglement/ingestion

- Beach interaction (prevention of hauling out due to presence of humans and dogs, etc) (more seals → more sharks?)

Ecotourism

Pollution

- Climate change** → suggested to be considered in context of discussion, but dropped from further discussion (too big an issue to be tackled today)
- Human perception and cultural issues play a role in each topic

- Need to talk about how to improve communication between different sectors
- There is an increase in different forms of ecotourism (kayaking, etc) → how do we get information to people before it gets to the point of nasty interactions? Should there be mandatory pamphlets distributed before people can go out? Is that enough?
- No state regulation → there is currently no mandate that people have to receive the information (eg. kayak tours)
- This is an area that can result in specific recommendations to NOAA
- Seal tours → can be good but have no regulations
- Need to work on reducing potential harassment in ecotourism context (or personal context)

- People driving on beach → give them a pamphlet of information about seals on beach before they are permitted access? May help prevent seals from getting hit by vehicles on beach as much
- Suggestion to develop a problem statement in regard to climate change (and other issues that couldn't be tackled today) for the proceedings
- Reminder that the intent of the workshop is to take what is being discussed today and taken into the future for further discussion (obviously not everything can be resolved today)

A. Marine Debris:

Issue: There is an opportunity for marine mammals to ingest and/or become entangled in marine debris (ghost gear, plastics, etc) (NMFS definition: material on the beach that cannot necessarily be identified from a specific fishery)

- **Specific recommendations should go forward with a better legal definition of marine debris**
- Observer Program used to collect data on sightings of marine debris

Recommendations:

- Stranding data needs to be incorporated into public information (people are generally unaware of what seals can ingest (eg. Frisbees)) → need awareness that this is what has been ingested, this is what they can get entangled in.
- Utilize data from Observer Program about debris for research efforts
- There are other groups working on similar issues → may be beneficial to tap into their resources, data (eg. Ocean Conservancy)
- Should find out what has been done already, see how information about marine mammals can be included
- Need to improve legislation about ghost gear (in Massachusetts cannot touch the gear → other than Cape Cod Bay, cannot remove gear from the water) → should be addressed on whale watches, etc to raise public awareness; would likely be met with positive response from fishing industry, because ghost gear interferes with active gear
- There needs to be collaboration between scientists and fishermen to take a stand on the issue
- Need to encourage the public to report ghost gear (public should not necessarily be at liberty to remove gear, as they may accidentally remove active gear)
- There are marine debris grants available from NOAA that may be useful to tap into

B. Ecotourism:

Issue: In context of public and private interactions; people conducting tourism whether or not they intend to interact with marine mammals

- Seal watches: there is a lot of vessel traffic with no regulations (other than MMPA, which they are not necessarily well educated about); no restrictions about who can run a seal watch tour company
- There is good existing data for certain regions (Alaska, some in Gulf of Maine)

Recommendations:

- Can take existing data from other regions to use as a model for how to move forward (guidelines, regulations, etc)
- Can look at whale watching guidelines as a model for emerging industries (seal watches) → whale watching has been around since before the MMPA was put into effect, has evolved accordingly
- There are new, emerging forms of ecotourism that need to be better understood (e.g. diving to swim with seals); there needs to be better awareness about what these forms are, what they may entail
- There needs to be regulation of who is running tours → should be registered and given essential information that can be used to educate the general public in the context of the tour
- There should be better awareness about the effect of different types of vessels on haul out sites (e.g. smaller vessels such as kayaks and canoes may flush an entire site because the movements are more similar to natural predator movements compared to larger vessels)
- Need to locate regional data on disturbances
- The best option is to concentrate on outreach initially → needs to include as broad a range of ecotourism as possible; there should be outreach at boat launch locations, etc; Add seal info to existing boater info
- Enforcement: guidelines are not easily enforced (e.g. MMPA guidelines on harassment); should be levels of enforcement (e.g. warning letters, reports, tickets), so as to prevent necessity to go through lengthy legal battles

C. Fisheries Interactions:

1. Depredation

Recommendations:

- Local fishermen would likely be supportive of research that would look into ways of decreasing depredation
- Gear modification research/look into new forms of equipment: acoustic harassment gear
- Bring fishermen to meetings to gain information on new equipment before they use the equipment (e.g. pingers) → currently conflicting data available about their use
- West Coast use of deterrents: seal bombs
- Issue of setting them off too close to the pinnipeds → may deafen the animals and make it impossible for them to be deterred further by other devices
- Investigate use of the permitting process to make it more effective for research on the issues → making the process more flexible may be an issue
- Need to investigate seal hearing capability → may make development of new deterrents more effective (rather than continuing to use tactics that may cause deafness)
- Use rehabilitation facilities as a platform for potential research in a controlled setting?

- Test different types (levels) of equipment, such as pingers (there is some potentially useful data available from Europe → should look into as a basis of understanding, use as a starting platform for future research)
- Current work is being done at Woods Hole on gillnets → look into?
- Look at fishing practices/human behaviors that may be attracting seals (e.g. fishermen cleaning fish, discarding fish carcasses from the back of fishing vessels → attracts seals)
- Work with the fishing industry to actually quantify the amount of depredation that has been occurring → is it happening more in certain areas, at certain depths
- Look into data from Observer Program (e.g. there is data available about if a fish is discarded because of seal damage)
- Conduct a workshop about depredation to bring together scientists and fishermen to initiate dialogue about the issue (develop means for preventing fish from getting away from the gear) → need to define 'nuisance' animals; need to explore possible displacement of prey species by seals (seals may be deterring fish migrations (e.g. in Nantucket Sound))
- Reconsidering the location of aquaculture facilities → could reduce the occurrence of depredation
- Possible sources of funding: NOAA, conservation organizations

2. Entanglement/Bycatch

Issue:

- An animal caught up by gear → may lead to entanglement
- Entanglement may be the result of attempted degradation or may be incidental (animal may not necessarily be attempting to feed on what the gear is catching)

Recommendations:

- Is it possible to quantify the percentage of seals that are caught incidentally versus those that are caught during attempted degradation? → a workshop with all fisheries would be helpful
- Need public outreach → alert the public that it is illegal/not safe to try to disentangle a trapped seal
- Develop more effective forms of gear that can easily be removed from a seal, rather than hauling an unwanted seal on board
- Develop training protocol for fishermen about how to disentangle seals → needs to be better communication about the process (they can call and be talked through how to disentangle)
- Need to have an open-format workshop between scientists and all fisheries
 - a road show team going from port to port may be a better idea (a non-threatening situation that would likely make fishermen more likely to talk about what they have experienced). Anonymous polls may be more attractive ideas for fishermen
 - NOAA internal communication

D. Education/Outreach Tools:

- How gruesome should images be? (Is more gruesome more effective for getting the point across?)
- Facebook (better than paper pamphlets → faster, more environmentally friendly)
- Encourage elimination of use of the term 'the wild'

- Revamp seal pamphlets: need to include more information about seal habits (haul out habits → need to let people know that seals have limited options for where to haul out and that a seal on the beach is not necessarily injured and in need of assistance)
- Kiosks with information near the beach or potential habitat areas (although that may meet with resistance from local towns that do not want more signs up)
- Local Outreach: work with local businesses, information centers to make information available to the public
- Need to make more of an effort to convene with fishermen → needs to be more outreach, make an effort to go to them first
- Need more awareness about human activities that will attract seals that can be curtailed (needs to be understanding that it is easier for humans to change their behavior than to expect the seals to change their behavior (eg. easier to stop cleaning and discarding fish on board than to expect the seals to stop feeding on the discarded fish) → more outreach in tackle shops, etc (ways of reaching private fishermen)

Disease and Health Working Group

Working Group Participants and Chair (*rapporteurs)

	S. Rogers Williams	group leader
1.	Andrea	Bogomolni
2.	Tiffini	Brookens
3.	Erica	Cote*
4.	Lynda	Doughty
5.	Charles	Innis
6.	Keith	Matassa
7.	S. Shawn	McCafferty
8.	Lena	Measures
9.	Connie	Merigo
10.	Michael	Moore
11.	Ole	Nielson
12.	Hendrik	Nollens
13.	Katie	Pugliares*
14.	Sarah	Sharp
15.	Trevor	Spradlin

Should we create a list of diseases of concern?

What is the point of this testing and reporting?

- “Disease” is often lumped together although very separate. Stranded animals usually are the source of biological samples but biased because they are compromised. Sampling these animals can help with recognizing morbidity/mortality trends – help with regional alerts or emerging disease. But why do this exercise? Is there treatment? What does it tell us? Testing and surveying will attempt to eliminate ignorance and need to know of reportable diseases (to CDC). Rescue of an animal that was entangled would be a different approach then dealing with animals that have active morbillivirus.

What are the Areas of Concern?

- Population Input (ie Morbillivirus)
- National Security and Food Safety (ie *Influeza, *Brucella, trichenella, giardia, cryptosporidium, leptospirosis, encephalitis, West Nile)
- Ocean Health (i.e. seal worm, algal blooms, contaminants)
- Animal Welfare (Individual) (ie entanglement, trauma)
- Natural History/Basic Science (some parasites)
- Human Health zoonosis, (otitis media, Brucella,*rabies)
- NOAA to introduce epidemiologist as tool

Top 10 diseases of Gulf of Maine Seals- What are the priorities, what needs to be further understood and researched?

Morbillivirus
Influenza
Rabies
Leptospirosis
Herpes
Toxoplasmosis
Pox
Lungworms
Vibrio
HABs

- We need to identify categories of disease and classify diseases opposed to simply stating that 40% of animals have died of disease. We need to make a comparison of testing healthy animals and compare to stranded animals by knowing what the baseline is. There is the issue of biased sampling, bycatch, hunted animals but there needs to be a comparison to healthy animals.
- All goes back to funding -there is not enough money to look for everything. At UNE there is requirement for testing Herpes, Lepto, Brucella, Morbilli.
- But this is on stranded animals however there is not enough funding/permit to test wild population.

We need to categorize Diseases/Health concerns by:

- Disease (DAMNIT scheme)
- Natural/man made
- Animal Group (hunted/subsistence, bycatch, stranding, rehab, proactive sampling)

Are there too many people involved? But at the same time there doesn't seem to be enough help.

- To prove disease you need to "known disease" and need to show beyond reasonable doubt as with humans. As in the 5 steps (Koch's postulate).
- Is that feasible for seals?
- The organism needs to be cultured from the animal and successfully transferred into another organism and again re-isolated.
- Need to know baselines and sensitivity of virus isolations of marine mammals.
- This needs to be done by integrating resources outside of the marine mammal labs as well.

Resources: (listed by participants)

Journal of Wildlife Disease
Dave Rotstein (NOAA)
Oklahoma Lab
MADlab
Tracy Goldstein UC Davis
USDA lab
NWHL lab
IDEXX

ProMed
Smart Teams
State Labs

- Comparative body counts for bycatch and strandings of three odontocetes peaked during UME in 2005-2006.
- Could there be more than one disease that is contributing? There is a seasonality and equal number of stranding and bycaught. It's surprising that no one in the room has heard about this until today.
- Suggestion: There should be an equal focus of health assessment of bycatch as there is for stranding. Standardized protocol for sampling, regional, strandings, bycatch. NOAA moving forward to include entanglement and bycaught as part of research base.
- We have the data but nothing is being done with it! There is no sharing of data and no analysis. We need a centralized database.
- There needs to be a shared database of stranded bycaught and healthy animal
- Shared data is a problem especially if samples are being sent out to numerous labs and there is a long turn around time. Lab analysis usually done post event. Epidemic over before can clearly identify what needs to be collected and processed.
- There needs to be consistency in sampling and banking throughout so that all facilities are on the same page and that if we need to go back to samples it is possible

What are the challenges?

- Events happen very rapidly and most testing doesn't happen until after the fact. An increase in numbers of bycaught and strandings should set off an alarm that there is something going on (ie HABs)
- Funding should be ready to go before a UME.
- "Smart Teams" individuals from each facility should be trained and ready to go in the case of an
- UME event for people to quickly respond to the beach and collect samples so that samples are not lost. At this point in time the only current "team" on the east coast is in the event of a right whale stranding.
- Need to enforce human safety as well, protective gear, safety training, zoonoses etc.

Examples of this scenario:

Ex) first case of influenza in seals in the Gulf of Maine (GOM). People got sick. Largest concern is human health.

Ex) Interactions with rabid coyotes. The entire story of morbillivirus is unknown and it may be helpful to collaborate with terrestrial biological research in looking at prevalence of canine morbillivirus along the coastline. Is it spilling over into the marine environment? Source of morbilli in seals?

- Need terrestrial wildlife personnel connected with stranding network to alert of morbilli prevalence or rabies in terrestrial populations.

- Who is our contact? Katie Brown. Information on local terrestrial populations is needed. Could this interaction become a growing problem? Likely more serious than we think? (In terms of) coyote predation -rabies is a reportable disease.

Phocid /canid interaction

- Challenge is that if we see an animal on the beach bitten by coyote with signs of rabies and take it to the facility to euthanize and we collect samples, most likely will not see rabies virus in testing.

We need a network of people interested in being on list of communication.

- Also need to be informed of what is going on in other regions
- Example: NMLC – rounds notes to veterinarians in region, short blurbs about current clinical cases.
- Morbilli: what is the difference of what is happening across the Atlantic?

Reporting: we need to get these cases out to others: (list made by participants)

JWD- Journal of Wildlife Diseases
Networking -Research Gate
Peer review
Newsletters/bulletin
Surveillance program
List-serve

What is the benefit of a list of “reportable diseases”? (list made by participants)

Management implications – legal sense?
Collect statistics
Example) Tularemia in cats is reportable, Is EEE in a delphinid big deal? Maybe? Maybe

not?

Example) Pp disease screening; What to do if we find positive results?
Need to test as not to be ignorant
Need method of making decisions
UNE and WHOI current leaders in disease screening in stranded/by caught (Biased

samples)

Need to include

How can we classify a list of reportable diseases?

- There is only so much funding and limited testing. Plus the list of diseases is always changing. Furthermore, animals are testing positive for more than one disease.
- What are the baselines? What are the chronic/toxic/effects?
- What diseases are enzootic?
- If population large enough for virus to circulate and then virus can spread to other populations. Do populations develop immunity?
- In the case of seal pups and morbillivirus, pups have immunity from mom. Once maternal immunity leaves, so the pups still have immunity or are we putting naïve populations into the environment?
- What are the reservoirs for specific diseases?

- Dave's idea involving epidemiologists can help identify specific areas to focus on.
- In an ideal world, there has to be some way to be able to pool data, each facility test for specific disease, all work on one grant.
- We have take reduction team for cetacean but not for pinnipeds

What we are doing is giving recommendations to NOAA: what are the priorities? Responders' needs/wants?

- Need to open door to priority diseases – what labs to send what
- Disease specific sampling techniques
- Funding for all sampling

How to start now? Use of Research Gate to share documents – quarterly case reviews

(Summary of Lists made during working group were reviewed- Lists below)

Population Impact Diseases

Morbilli
Brucella
Herpes
Lepto
Influenza
Contaminants
Pathogen/Resistance
Lungworm
Septicemia in pups
Nocardia
HAB
Toxoplasma
Coxiella

Food Safety/Human Health models/zoonoses

Toxo
Mycoplasma
Brucella
Trichinella
Flu
Giardia
Rabies

Ocean Health

Abx resistance/ immune function/ suppression
Contaminants-flame retardants
Pathogen pollution
HAB

- By-catch
- Ship collisions
- Malnourishment
- Climate change
- Noise pollution

Individual Seal Health

- EEE/WEE
- Cestodes
- Parasite
- Immune function
- Otitis media
- HI: Trauma/entanglement and secondary bact /fungal infections
- Pox
- Vibrio
- Morbilli
- Pneumonia
- Dermatitis
- Alopecia
- Septicemia
- Body condition
- Dehydration
- Foreign body ingestion

Natural Science/History

- Parasite
- Endogenous retrovirus
- Stable isotopes
- Antibiotic (Abx) resistance/ flora/fauna
- Pox
- Climate change

Human Health models/zoonoses

- Toxo
- Mycoplasma

What diseases do we need to contact state dept., USDA, CDC etc? We need to know what to report.

- **Morbilli
- **Influenza
- Brucella, Herpes (enzootic?) , Rabies, etc.

What factors are most important to ocean health?

Antibiotic resistance, contaminants, pollutants, HAB

The network needs to create a list of priorities of what diseases need to be studied, create a list of labs and costs of where samples can be sent.

Recommendations:

- 1) First priority: NEED BASELINES (unanimous). What are the normal values?
- 2) Pool of money to be used for diagnostics – contributed by each network member. Samples would be sent in from each species each year. The idea is to have a sample size of $n=30$ for a given population. (Either species, age, sex, whatever the given criteria)
- 3) Speed of UME /Criteria – improve. There are too many steps to go through before a UME can be declared, and it can take weeks. By the time the UME is declared the event is over.
 - Need to know/improve labs to test for diseases/findings
 - We are spending too much \$\$ and not enough information
 - Establish a pool of money
 - During a UME designate a 'gatekeeper' to send target samples
 - Create a manual to establish a standardized sampling protocol across network. Make resources easily accessible ahead of time. Hendrik Nollens - sampling manual, Katie Pugliares/WHOI/IFAW- necropsy manual, Geraci-Marine Mammals Ashore
- 4) Collecting samples in standardized fashion based off of above-mentioned resources; Establish NOAA recommended labs for disease screening with the aid and direction of an epidemiologist.
- 5) Establish when should animals NOT be released back into wild. Morbilli, Influenza, etc. (Before we can make this decision, we need to develop a baseline on the wild population).
- 6) Establish baseline through live capture research opportunities. Need collaboration of human health and marine researchers; make more of permits and research doing live captures; take opportunity to collect blood/samples. Contact Scotland crew about health assessments protocol/ideas; international spin for multiple projects.
- 7) Establishment of Northeast Marine Mammal Health Consortium. MMOORE – WHOI can be the lead for this in establishing the center of the consortium.
- 8) Need a lead to find collaborators and write for grants

General Discussion Notes

Question: Is there public pressure to rehab of animals in Canada?

Response: On Canadian east and west coasts there is a difference in opinion. On the west coast there is some pressure to rehab seals and there is a rehab center in Vancouver. There is an effort to educate people regarding natural mortality. On the east coast there tends to be less concern because of the seal hunt. There is occasional public concern regarding sick/abandoned pups. The Quebec aquarium wanted to set up rehab but were asked not to protect St. Lawrence Beluga. A vet school wanted to rehab as well but permit pulled due to proximity to cows. There is no national policy regarding rehab in Canada

Response: There is strong public pressure in U.S. –even by fishermen – to rescue animals.

Response: Arctic Canada perspective: a large pod of narwhals were entrapped last year. They were enclosed by ice. There was a huge outcry in the press for the Canadian coast guard to intervene. The issue made it into parliament but there was no funding to rescue them. Additionally, logistically it would have been a difficult rescue due to large amount of ice the animals were entrapped in. Decision was to harvest the animals – they were shot and distributed for food.

Question: Would they have worked to protect the St. Lawrence beluga?

Response: Likely, yes. But they are river species so likely easier to rescue and also is an endangered population

Question: How will the results of the workshop be used? Advice and recommendations for NMFS? Will this workshop influence policy?

Response: If you (we) come up with a strong enough response – then it could be used to influence policy. All options on the table. A lot has to do with what is articulated and how well it is justified. We have an emphasis on networking as a goal of the conference. One problem with meetings in the past has been follow up.

Response: I'm not sure how much influence this conference can have on legislation but it might encourage funding of research. Current funding for research is totally inadequate.

Response: One goal of conference is community building. We may not reach a consensus but the discussion is important.

Question: Is there any benefit to abundant seal populations?

Response: The fact that there is no obvious biological problem with population can lead people to become 1) apathetic or 2) upset about seal populations. Have a polarizing, value based effect.

There may be difficulty framing issues in a problem solving context. The elephant in room is the question of over-abundance. How do you determine if there are too many?

Response: Question of overpopulation has been around for a while- it's an unscientific question. I'm a bit shocked by how this discussion is going because we live in a changing world and a warming world. This may affect the distribution of species. When we discuss these issues we need to take larger world issues into account including global warming. There was a workshop in 1981 on seals on Cape Cod. A chapter informed from that workshop entitled "Overpopulation" (Caughley, G. 1981. Overpopulation. Pages 7-9 in P. A. Jewell and S. Holt, editors. Problems of management of locally abundant wild mammals. Academic Press, New York) was informative and can be shared if desired. (edit note – a copy of this paper was posted on "ResearchGate")

Response: One of the things we might do is make recommendations to NMFS to encourage them to integrate stranding efforts into their other efforts. I see people working in boxes without much communication between them and this results in misinformation. If we could come up with strategies to better integrate this info it would be more powerful.

Response: Compared to years ago, it seems like there are more people doing more work on a higher level now but it's far more diffuse. A greater variety of people doing work but this creates communication problems/logjams.

Response: Even if the recommendation is: we need to find out more about interactions between fisheries and people; we need to decide how to frame these questions. Perspective shapes research i.e. "seals are eating all the fish" vs. "seals are not eating the fish". On the West coast the perspective tends to be: "seals are eating all the fish". This skews the information base. When we think about what we are going to recommend we need to bear this in mind

Response: Part of the issue is how to frame question so that it gets funded and "seals are eating all the fish" seems to be more fundable.

ResearchGate

ResearchGate:

An on-line professional networking and discussion space for Pinniped Researchers and Stakeholders <http://www.researchgate.net>

How all this got started - - - a networking parable.

During the early stages of planning this workshop, the organizing committee set up a conference call. During that call one member offhandedly remarked that they had photographs of seals on Monomoy Island that appeared to show some odd skin condition or wounds. They wondered if anyone would be interested and to whom they might be able to send the pictures to get a better idea of what the marks might be. This short digression turned into an hour or so of discussion, speculation, emailing files, head scratching and generally searching contact lists - time that we did not spend on our real workshop planning agenda – figuring out what to do about the pictures.

It seemed clear to us, however, that there should be a better way to more easily contact people with appropriate interests to share information and ideas. What we hope to do with ResearchGate is provide a place where contacts may be more easily maintained, information more easily shared and projects and ideas addressing problems large and small be more readily developed. At ResearchGate, keywords, links and profiles make it easy to locate individuals with appropriate interests and expertise among members. Alternately a discussion group as a whole can be easily contacted. The collaboration tools at the site make it easy to distribute files and work together on shared information.

It is with this, and similar situations in mind that we started the group at **ResearchGate**. Please explore - try it out, and help to create and be a part of an active online seal research and information community.

Our meeting in Woods Hole has three broad objectives. These are (in no particular order):

1. To build community among stakeholders with an interest in pinnipeds
2. To identify issues surrounding pinnipeds living in the Gulf of Maine
3. To formulate strategies and suggest tools for addressing important issues

In an effort to improve communication, and build community among those with an interest in pinnipeds in the Gulf of Maine we have begun an on-line discussion group through a professional scientific networking web site – ResearchGate <http://www.researchgate.net> - and we are encouraging your participation in both the site and the discussion group. We feel that joining and

using this site and discussion group will improve communication, coordination and networking while expanding and continuing the efforts to meet our objectives beyond the limits of a two-day meeting.

ResearchGate launched in the spring of 2008. It was established to encourage networking, research and collaboration among scientists and presently has over 20,000 members and over 1,000 discussion groups (one with over 1,200 members). To better carve out our own space within this growing site, we created a discussion group “Gulf of Maine Pinnipeds” as a networking and discussion space within ResearchGate.

Begin by joining ResearchGate as a member. Membership is free.

You will be asked to create a professional profile as a member. This profile allows you to identify yourself, your research fields and interests. It will also be a way to connect and network with other members as well as managing professional contacts. Rather than providing workshop participants with a simple email list of contact information, we hope that this will provide more in depth and detailed information about those attending or interested in the workshop. Your profile may be as detailed or brief as you wish.

Once you have signed on to ResearchGate, click on the “Groups” tab at the top right-hand corner of your home page. Use the search box to locate the group **“Gulf of Maine Pinnipeds”** and sign up for the group. This should bring you to the home page for the group.

Within “Gulf of Maine Pinnipeds, we have created four **discussion areas** – three corresponding to the discussion groups of the workshop and a group for general discussion. We have asked the chairs of each of the workshop working groups to start discussions in each of their on-line counterparts. We urge you to make use of these discussion areas to continue discussions beyond the walls of the meeting. Feel free to take part in any or all discussion groups. “Gulf of Maine Pinnipeds” and the discussions within this group are visible only to other members of the group.

We have posted **background and reference material** under the “files” tab of the group. We hope that these files will be useful for discussions both in the workshops and beyond. There are also numerous tools built into the group that let us poll members, set meetings or appointments for meetings, email all members etc. We have not limited membership to the group and anyone may join if invited by group administrators or by other members.

ResearchGate has many **useful tools and features for research, collaboration and writing** including literature searching (of more than 30,000,000 documents) and tools for building and organizing a research library on the site from abstracts of preferred references. We encourage you **to explore and try it all out.**

Acknowledgements

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